SEP 17 1923

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Surveying in the Sudan, Egypt. No hill being available, a tree was used as a triangulation station, and a scaffolding of rough timbers erected. The top of the tree was cut to form a base for the transit

How to Calculate Tonnage and Grade of an Orebody

By James E. Harding

Selective Flotation of a Complex Zinc-Lead Ore

A description of the new Kimberley concentrator of the Consolidated Mining & Smelting Co. of Canada

By George J. Young

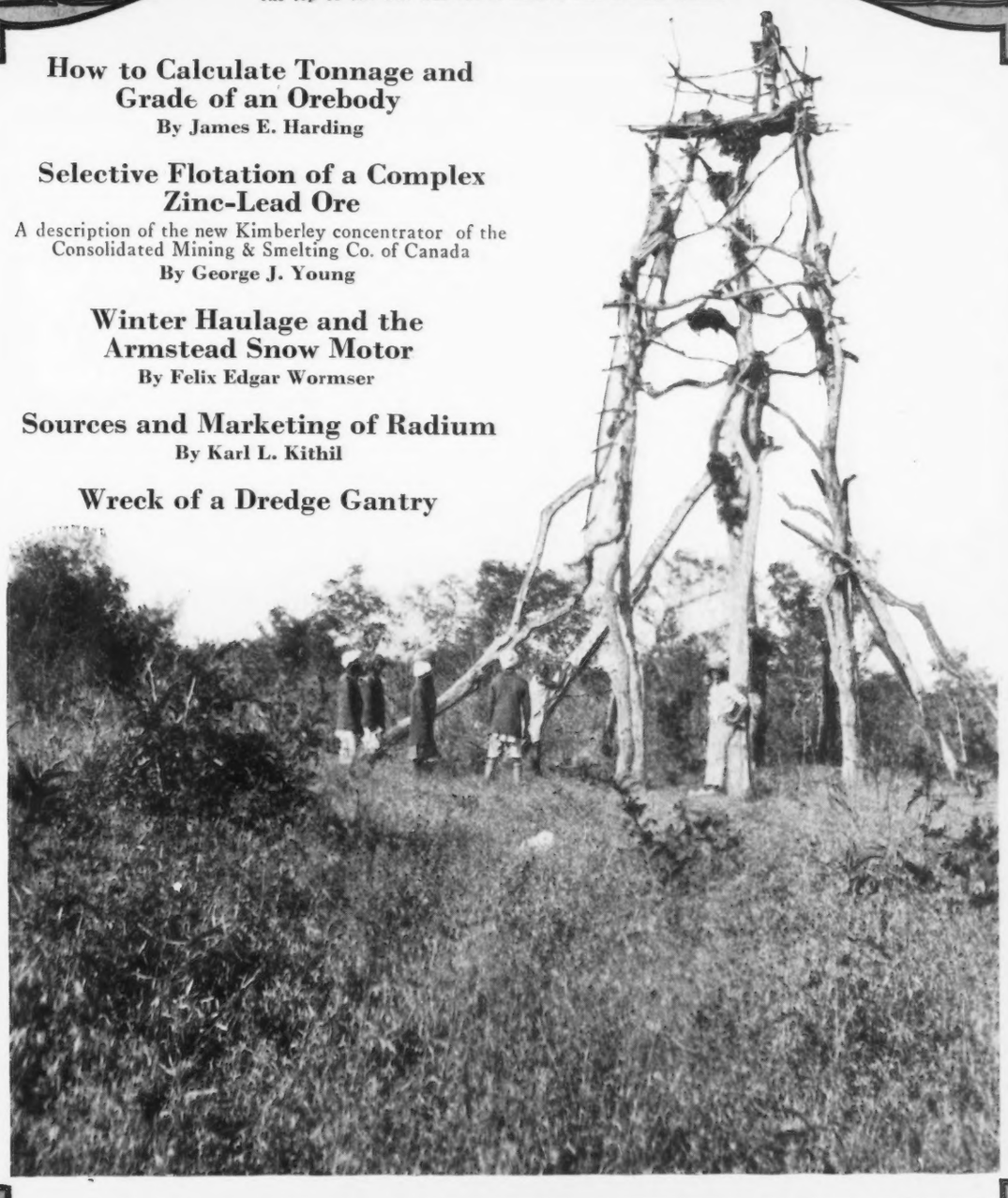
Winter Haulage and the Armstead Snow Motor

By Felix Edgar Wormser

Sources and Marketing of Radium

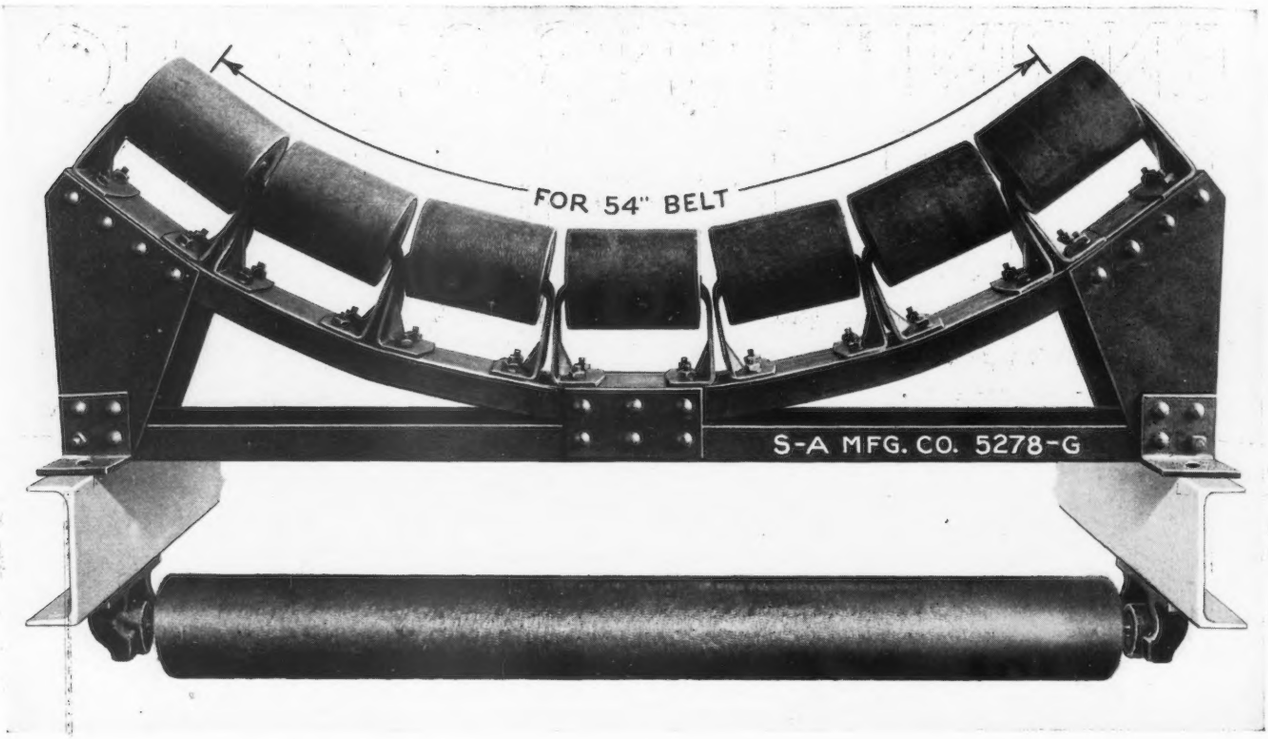
By Karl L. Kithil

Wreck of a Dredge Gantry



A WEEKLY JOURNAL REPRESENTING THE WORLD'S MINING AND METAL INDUSTRIES

September 15, 1923



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ENGINEERING & MINING
JOURNAL-PRESS
JOSIAH EDWARD SPURR, Editor

Volume 116 New York, September 15, 1923 *Number* 11

Selective Flotation at Trail, B. C.

THE EXPERIMENTAL WORK upon ores of the Sullivan mine by the Consolidated Mining & Smelting Company of Canada, resulting in the adoption of selective flotation as a method of treatment, is noteworthy in that this ore is of the zinc-lead complex type and a particularly difficult one. The differentiation of the lead and the zinc and iron sulphides during formation was only partial. Apparently the ore magma was a viscous mass that solidified quickly before the individual mineral species could form sizable crystals. Undoubtedly, flowage was in progress during solidification, as this would account for the thin wavy bands that are noticeable in hand specimens.

The fractured surface of the ore suggests the fracture of a ferro-alloy. Although the ore is to be crushed to a 200-mesh screen, it is obvious that this will not be sufficient to separate the mineral species completely, and that, therefore, separation by flotation can not be complete. Separation by flotation or by mechanical methods is limited by the degree of separation attained in crushing. This is fundamental. Nevertheless in the specific instance, the efficiency of selective flotation is remarkable. Fortunately, the end products, galena containing blende and iron sulphides and blende containing galena and iron sulphides, can be readily and efficiently treated, the one by sinter-roasting and blast furnacing and the other by roasting, solution in sulphuric acid, and electrolytic deposition. The interdependence of supplemental processes and primary separation methods is well illustrated in this important example.

Earthquakes

THE VOLCANIC DISTURBANCES of nature, when they become violent, throw into the shade all that the violence of man has yet been able to devise in the way of destruction. The earthquakes and the resultant tidal waves in one volcanic region, Japan, quite obscure in the news the wearisome swashbuckling of Italy and Greece around another volcanic region, the Mediterranean. For the Japan titanic upheaval, measured in terms of humanity, was a major disaster, with a loss of life rarely equaled; and was a blow at Japan's wealth and power, delivered unexpectedly, in a few moments, which more than offset all that the diplomacy of Japan succeeded in avoiding in the World War.

While popular thought at once finds the closest analogy in the San Francisco earthquake of 1906, which destroyed the city (principally, as at Tokio and Yokohama through consequent fire), yet in the same general class of phenomena are the eruption of Mont Pelée in 1902, whose gases destroyed 28,000 inhabitants, along with their city of St. Pierre; or the eruption of Krakatoa in 1883, which resulted in a tidal wave which destroyed more than 36,000 people, with their habitations; or the eruptions in Iceland in 1783, which more or less indirectly, through famine and plague, caused the death of over one-fifth of the population of the island. The final toll of Japan's loss of humanity promises to be far greater than any of these.

A curious sense of realization of the insignificance of man and his works is recognizable in such a crisis, even among people who in general consider themselves at the base of the pyramid of nature and nature's works. What avail laws, shops, creed, or money in bank, they ask themselves, against the rending apart of the solid earth itself, against the belching of gases whose magnitude shames the diabolism of the German armies? Tokio, the greatest and proudest capital Asia has ever seen, is overthrown; and the nations rush to its rescue. A few more scattered catastrophies like this would unite the world, in common terror.

Is New York and its proud skylines safe? While there is no portion of the earth's surface which may be theoretically guaranteed as earthquake-immune, yet it remains true that earthquakes, small and large, and resultant tidal waves, are highly characteristic of regions of present or recent volcanism. The most important region of this kind in the world is the Pacific basin, encircled by its "rim of fire," represented by the torches of the volcanoes which surround it and by the still unscarred cones of volcanoes not recently active, but which threaten to break out again at any moment. In this zone of constant threat lies the west coast of South America, where destructive earthquakes and tidal waves, especially in Chile, are well known; the west coast of North America, including Mexico, and to a less extent, California. Thence the zone of greatest danger runs through the turbulent Aleutian Islands of Alaska, where volcanic islands have been known to come up and others to sink beneath the sea, in a catastrophic way, (but since the region is practically unpopulated, without loss of life), and thence the line of weakness and inner turbulence runs through Japan and so on south.

New York is situated in an ancient region that has had its volcanic fires; but these fires are now long since dead—many millions of years ago. The last outbreak of lava in the vicinity was in the Triassic period, the lavas of which are found both in Connecticut and New Jersey; and even this was not a period of major volcanic violence, like that activity now existing in Japan and many other regions around the Pacific, and in other volcanic regions like those of the West Indies and of the Mediterranean.

Science is pitifully unable to foresee and safeguard against these fatal uprisings of the earth. The delicate instruments—seismographs—which have been invented, simply detect tremors which the human mechanism does not feel. It is, moreover, highly improbable that science ever will be able to calculate in advance earthquakes and tidal waves; or that the seismologist will ever be much more than a recorder of past disasters.

At San Francisco the fissuring and faulting of the surface has led to the belief that the disaster was due to

fault movement; but it is more likely that the faulting was the effect of the earth movement than the cause. Volcanic paroxysms, in which gases play a large part, are probably the principal causes of disturbance of the peace. Prof. J. P. Iddings wrote in 1914: "The subterranean noises and earthquakes that precede the first outbreaks of lava at the earth's surface, and in some instances continue for months, testify to the greatest rupturing of rocks above the rising magma and the comparative slowness of the process of blasting its way upward"; and again he observed, "Fuji Yama has not been in eruption for over two hundred years, but it would not be wise to assume that it is extinct." Therefore those who tell us that a recurrence of shocks in Japan for a time is unlikely simply are having their guess at it. Many times Vesuvius has overwhelmed the population on its sides since the days of Pompeii and earlier, and each time new inhabitants swarm up to plant their vineyards on its slopes. Mankind returns to its works and life with the pertinacity of ants. And so will Japan rebuild, whether or no catastrophe recurs.

It is interesting to recall to miners that the rim of the Pacific, which is the greatest terrestrial danger zone on earth, is also the greatest mineral zone on earth, for ore deposition is allied to volcanism, as is now well known. But recent volcanism is not necessary for a rich mineral zone; for in regions where volcanic disturbances ceased eons ago, the metalliferous veins which were a part of the igneous phenomena still stay, and where exposed by erosion yield rich and long hidden treasures.

Under Fire Again

THE Pittman Act has so often been severely criticised by persons poorly informed regarding the history and machinery of the act that one more or less attack upon it makes little difference. It survived because it was sound, because it affected no one's pocketbook, and because it was a great aid in winning the war. Now that the repurchases of silver by the government under the act have practically ceased, and been completed, a recent tirade appearing in the editorial columns of a New York newspaper comes somewhat late. But it is so illogical in its criticism of the Pittman Act and the motives of the silver miners, that it should not pass unnoticed. Thus the following unpleasant remark is made, . . . "one of the most obnoxious and indefensible subsidies was that which was paid to the silver mine owning interests." We have replied so frequently to groundless accusations, such as this one, that our pen grows tired at the repetition, but coming from such an organ as the *Journal of Commerce* this statement cannot go unchallenged.

A subsidy, according to our notion—and we are supported by Webster in this contention—refers to a grant from a government to a private enterprise for the support of that establishment; it is a gift paid out of the tax collections of the government. In its last analysis, it is a support by the people of some business or trade. The Pittman Act, as the mining industries know, was nothing of the sort. The government did not gratuitously give the silver miners a dollar. For every cent the government dispersed it received a full cent in return, so far as silver transactions under the Pittman Act are concerned. The silver miners never asked for anything during or after the war that was not eminently fair and honorable to everyone.

How mistakenly the editorial interprets the attitude of the miners is shown by the following extract: " . . . . the mine owners have had a long drawn subsidy which is about at an end, and they are trying in some way to get it extended through the pretense that foreign silver has been bought, or through blunt demand for extension of a government purchase policy in favor of the domestic product. . . . What these gentlemen want is a subsidy."

This is news to us, and we thought we had been following the silver question rather closely. The miners do not want a subsidy. They want the best price for their metal they can get in the world's market and an assurance that they are not at the mercy of foreign manipulation of a financial or political nature in establishing a price for it. Possibly the *Journal of Commerce* had the gold miners in mind when it wrote its attack, for it is a matter of record that several years ago the gold miners did ask for a subsidy, but that effort fell through long ago and has not been revived. The silver miners have never gone so far, however, and this latest denunciation of them shows a lamentable disregard for the facts.

Journalism and Nationalism—Thoughts at Random

IN THE OLD DAYS of small-town journalism, the rival editors of the local sheets were wont to call each other opprobious names and impute to each other unrighteous motives, even though they might meet over a glass of beer in the evening and bewail the hard lot and poor pay of the editor and publisher. This has pretty much gone out of fashion, even in the backwoods towns. In mining journalism also it has mainly gone by, though it crops up now and then in the rural districts: but not so very long ago the "vicious crack" at his contemporary, whether fair or not, was part of the mental exercise of ye editor, whereby he gained a certain kind of reputation and lost another kind, in the minds of his readers and of the profession. Nowadays, we have contemporary mining journals which we like to open, and indeed we do not remember that they are in any sense rivals, so pleasant is the scanning, and so sure the feeling that one will not find what is unfair or raw. Such journals, for example, are the *Canadian Mining Journal* and the *Mining Magazine* of London, and others, of course, which come to our minds less readily. The number of the *Canadian Mining Journal* which greeted the engineers of the Institute on the Canadian trip was full of valuable articles, suited to the needs of those who took the trip.

It is only a coincidence that the journals we mention are both within the British Empire. There should be little thought of nationalism where mining science or technology—or even journalistic science—is concerned. Yet we know it will crop out; we know that one can point out repeated transgressions of this sort in ourselves. There was a time, if tradition and literature are to be relied upon, when the excessive nationalism of the United States was rather a matter of amusement to the world. Our observation is that the cosmopolitan spirit and wide world sympathy is now better developed in the United States than in the minds of our British cousins. On the Canadian trip of the Institute, the speakers and toastmasters dwelt rather too much on the fact that President Mathewson was born a Canadian, which from our point of view, was really neither

here nor there. And at one banquet the toastmaster, as his first act in a dinner given to his visiting guests —members of the A.I.M.E. and their womenfolk— bounded to his feet, and with energy proposed "Gentlemen—The King!" and when his toast had been courteously heeded, sat down and let it go at that. One could not help but feel for the ladies and Mr. Coolidge. But these are, after all, small thoughts when one considers the universal hospitality and friendliness.

Promotion Literature

HOW FAR may a promoter go in making claims as to the ore possibilities of his property? The answer would seem to be that he may not exceed the bounds indicated by competent geological opinion. But would this be sufficient to interest the general public? Recently an engineer in commenting on a promotion of rather dubious character defended the promoter's literature and statements on the ground that work of promotion was essentially one of salesmanship and that all salesmen were inherently dishonest. The doctrine of *caveat emptor* means that it is up to the buyer to watch lest he be cheated, but this is very different from saying that all salesmen are liars, which is by no means true.

A straightforward statement about the average prospect, pointing out the chances of failure as well as those of success, undoubtedly would not rouse the interest of the general public to the point of buying stock. In speaking of the public one must divide it into three groups: one group that constitutes the real mining industry and that makes ore production its regular business; a second group that knows nothing of mining, but in its simplicity and ignorance regards a purchase of any mining stock whatever as an investment, and, having purchased it, fondly and hopefully awaits dividends, which any company getting wealth for nothing right out of the very ground, as this group sees it, may naturally be expected to pay; and the third group which regards the purchase of mining stocks as a gamble and nothing else and puts it in the same class as faro, roulette, and horse racing—quite as risky and nowhere near as exciting. The last group is commendable for its frankness. "Blue-sky" legislation is unpopular with it, just as restrictions on race-track gambling are unpopular with many in New York. There is, of course, a fourth group—those who are not attracted by mining at all.

A frank statement as to a prospect's chances does not hurt it in the eyes of the first of these groups, the real mining group. Indeed, this group will accept no statement but must see for itself before spending a cent. It will have frankness and nothing but frankness. It is prepared to take long chances as a part of its business. It is the second group that is hurt most by fake promotions and from which the ranks of suckers are recruited. This group is by far the largest, for most of the populace is essentially honest, simple, and unbusiness-like. It is this group that "blue-sky" legislation is intended to protect. The sporting third group needs no protection, being wise in its own generation and able to look out for itself, and regards the second group as "easy marks," deserving neither sympathy nor protection.

Obviously, there is little chance for mining profits for the second group, for it "invests" blindly, and if it realized the facts, would not spend its money at all.

The sporting third group is not interested that the men behind an enterprise shall be honest any more than it cares much whether the prospect really has any ore. Its sole concern is: what are the market possibilities of a company's stock? If it looks at the personnel of the company's directorate at all it may be to see if it contains names that will impress the "easy marks," but more likely, it is to speculate as to their ability to manipulate the stock. "Better should the president be a crook," said a young East Sider who had bought $50 of some unknown stock on a little flyer, and who wandered into the office to find out about the chances of its becoming active.

It is the sporting third group from which most of the opposition to "blue-sky" legislation of any kind has come. There are others, in the first group, perhaps, who sincerely think that such a curb would seriously restrict legitimate enterprise. But these admit the need of something to check bogus schemes devised to fleece the public.

Brokers, who make their living by the sporting third group, are the most vociferous against "blue-sky" legislation. In every stockbroker's sheet they have a mouthpiece from Los Angeles to Spokane and from San Francisco to New York.

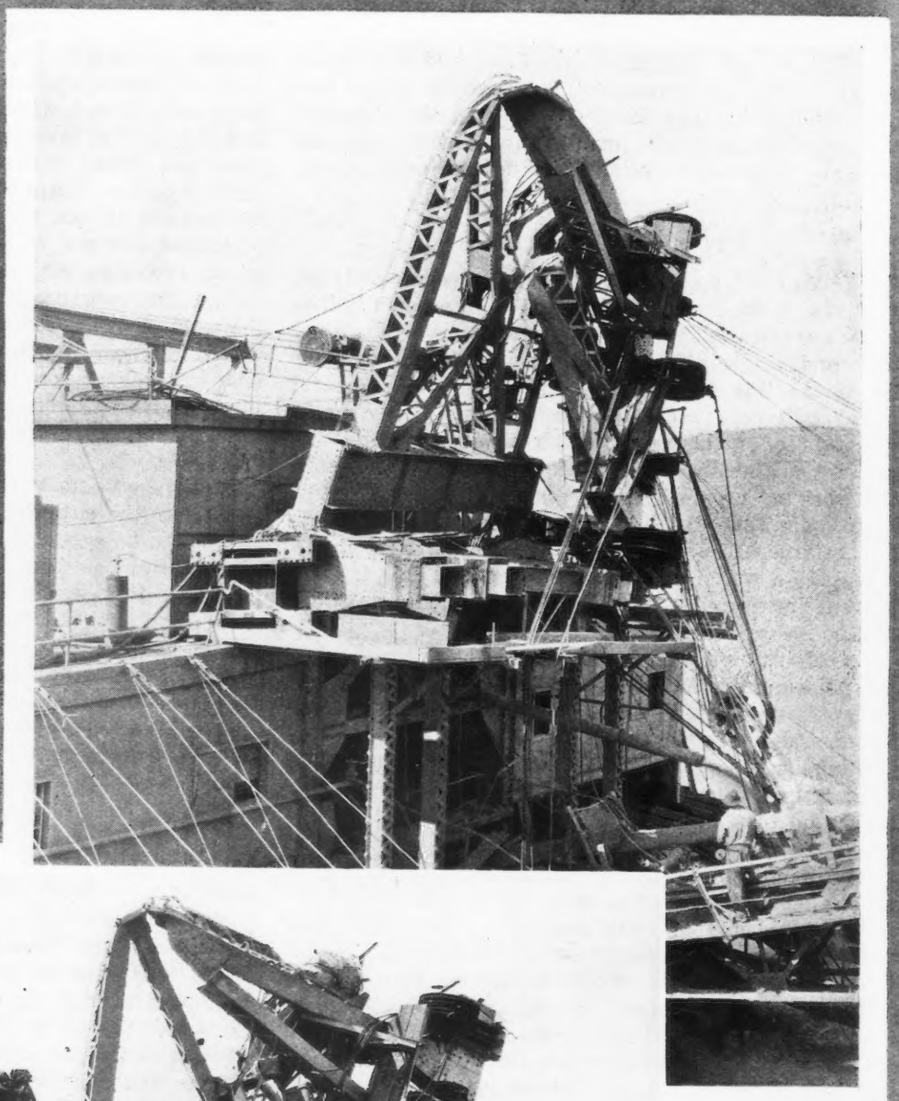
It is easy to concoct arguments to make dishonesty appear honest and to deceive the simple. It is easy to overpaint a prospect's chances. Specific refutation of such statements is generally difficult. But the intelligent can usually spot a crooked enterprise, and if they have no axe to grind, will not hesitate to give it its proper name.

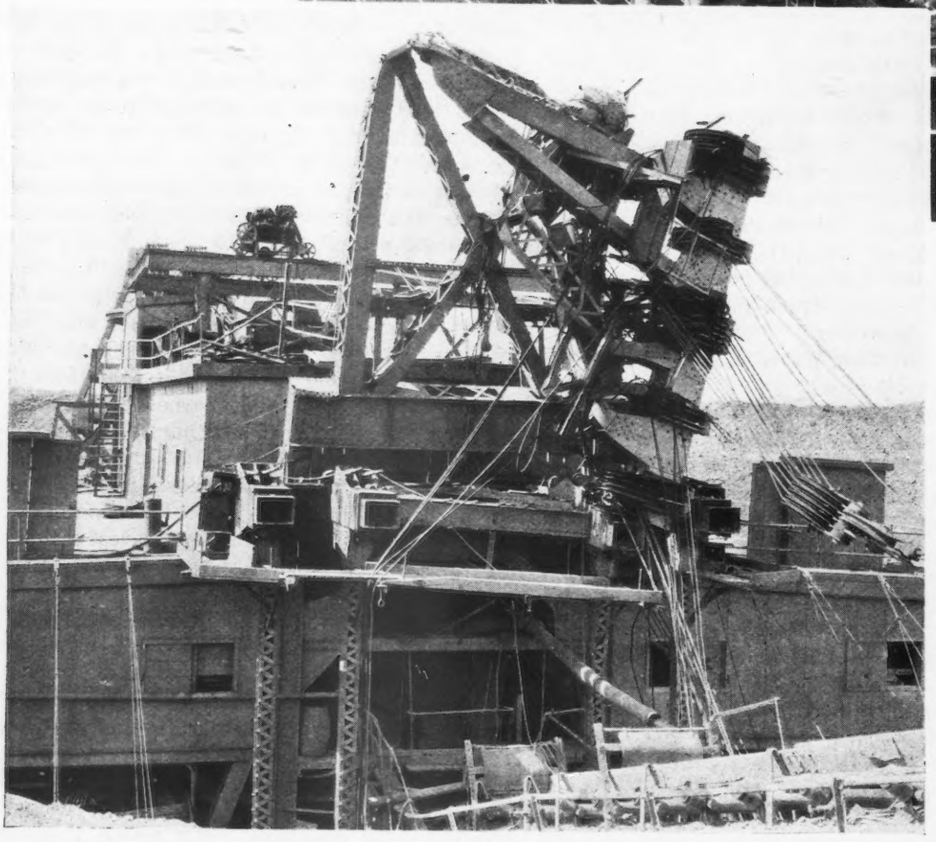
The Tribulations of an Editor

"ZN," THE attractive monthly bulletin of the American Zinc Institute, had a birthday recently. The occasion was the appearance of the twelfth issue in its enlarged form. In retrospect the editor made a few remarks in his editorial columns which call for such sympathy and consolation which only one editor can give to another. We quote: "While the reaction (to the Bulletin) from quarters outside the Institute membership has been most gratifying, yet the Managing Editor cannot help feeling, from surface indications at least, that the Bulletin is not the success which the spirit of the publication and the work it entails warrant so far as the Membership is concerned. On more than one occasion vital matters have been introduced for discussion without a sign of reaction from the Membership. Members have been frequently asked to contribute . . . with little or no response on their part. It is not displeasing to hear some of the members say that the Institute is publishing a fine Bulletin, but it is discouraging to learn that their admiration cannot possibly extend beyond a view of the front cover."

Editing, like other arts, has a psychology, and although we don't recall ever having seen anything published about it, these phenomena that Mr. Tuthill, Secretary and Editor of "Zn," so frankly sets forth are entitled to respectful consideration as first-hand observations when such a volume comes to be written. On our part, we can furnish additional data, and so can thousands of other editors, to show the lethargy of subscribers or members when action is desired. We hope Mr. Tuthill will not be discouraged, but will keep up the good work he is doing.

The gold dredge of the Marysville Dredging Co., operating near Marigold, Calif., was partially wrecked early in August. While spuds were being changed, the stern gantry collapsed, fatally injuring one of the dredge employees. Repairs are now being made. The accident is a most unusual one in gold dredging.





How to Calculate Tonnage and Grade of an Orebody

Usual Practice Ignores Important Factors—Formulas Suggested Have Wide Application and Eliminate Personal Taste and Judgment

By James E. Harding
Mining Engineer, Antofagasta, Chile

James E. Harding

THE "expectation" of a mining enterprise, speaking generally, is based upon removing ore of a calculated tonnage and grade from a given orebody. This tonnage and grade are calculated from the assays of small samples. In view of this fact it is rather peculiar that, in estimating such tonnage and grade, more care is not used. Frequently operations fail to recover ore of either the tonnage or grade expected; if the difference between expectation and realization is too great, failure is the result. Even if failure is not the outcome, the expected profit on the investment is not returned. Some few instances there have been when grade and tonnage were both above expectation, but rare have been the cases where tonnage and grade have agreed with the expectation.

Purely from a mathematical standpoint, the error is just as serious whether the realization is greater or less than that calculated. Stockholders, however, always have been of the opinion that mining a lower grade or less tonnage than calculations called for is more serious. With a wary eye to this contingency, engineers have been in the habit of making a calculation with great care, and then reporting a result obtained by deducting sometimes as much as 25 per cent. Though such practice can be defended on the ground of conservatism and "safety first" for the engineer's future, it is indefensible in its mathematics.

The method which is used in laying out the system of sampling an orebody greatly simplifies or complicates the methods which must be used, or at least should be used, in the calculation of its tonnage and grade. Most large orebodies are sampled by some means of drilling to procure a series of vertical or nearly vertical samples. In some cases holes are drilled at the corners of squares, or at the apices of equilateral triangles, and in others the holes are drilled without regard to the regularity of spacing, in a sort of hit or miss fashion. Though this last method should be strongly condemned if regularity of spacing is permitted by topographical conditions, it must be remembered that orebodies are generally found in a country so rough that no regular system of spacing can be laid out and followed without unwarranted expense. Whatever the method of spacing holes may be, the orebody is divided into a series of prisms whose sides apex at the hole. The tonnage and grade of ore in each prism is calculated and then the sum of the tonnages of metal divided by the sum of the tonnages of ore gives the average grade of the orebody.

No matter on what plan a drilling campaign starts, it is almost certain to wind up by putting down check holes to prove up doubtful territory. Such check holes are bound to break the regularity of the spacing, and call for special methods of calculation. When, as is almost certain to be the case, there is a wide variation in the depth and grade of ore in adjacent holes, as well as in the distance of one hole from another, potent factors and sources of error are introduced into the calculation. In spite of so many possible sources of error, in the calculation of tonnage and grade of ore in a prism, one method is generally used. That method treats all prisms alike, regardless of symmetry as to sides and angles, and of the degree of scalenity. The volume of the prism is found by multiplying the horizontal area by the figure representing the average depth of ore in the holes. This expresses the volume as cubic feet, cubic meters or other unit. Multiplying the volume by the number of tons per unit of volume gives the total tons contained in the prism. The average grade of ore is found by dividing the sum of the products of the depth of each times its corresponding grade, by the sums of the depths of ore in the various holes. In the case of equilateral prisms only is such a method correct.

Having had to supervise the calculations of orebodies, I have spent a great deal of time in attempting to devise methods applicable to the various conditions encountered —methods that will give approximately accurate results, no matter how applied. Let anyone who has the curiosity to do so, assume four drill holes varying considerably in depth and grade, so situated that they form a trapezoid. Place two high-grade holes at either of two opposite apices and two low-grade holes at the remaining apices. Then divide the trapezoid into two triangular figures and calculate the tonnage and grade of ore contained. Then divide the trapezoid in the other possible way and calculate the total tonnage and grade contained. The results will show a difference that may be startling.

Because of the impossibility of arriving at satisfactory results by regular methods other methods have been worked out, to take care of conditions commonly encountered in calculation work, for various shapes of prisms. I believe that there is no possible method of spacing drill holes to which one of the following methods will not apply. All the different formulas and calculations are based upon two simple but reasonable assumptions:

(*a*) That between any two sampling columns, the

grade of ore of either one is assumed to extend half way, and half way only, to the other.

(*b*) That in any prism, the grade of ore at any point is assumed to be that of the nearest assayed sample.

The following cases, then, have been worked out with

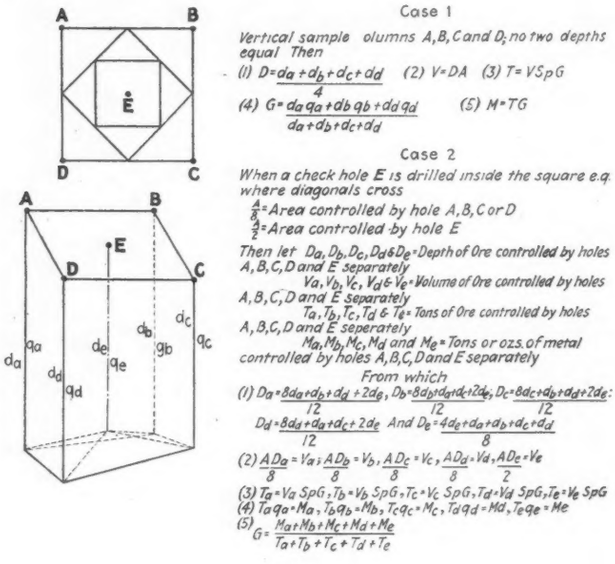

A
B
E
D
C
Case 1
Vertical sample olumns A,B,C and D; no two depths equal Then
(1) $D=\frac{d_a+d_b+d_c+d_d}{4}$ (2) $V=DA$ (3) $T=VSpG$
(4) $G=\frac{d_a q_a+d_b q_b+d_d q_d}{d_a+d_b+d_c+d_d}$ (5) $M=TG$
Case 2
When a check hole E is drilled inside the square e.g. where diagonals cross
$\frac{A}{8}$=Area controlled by hole A,B,C or D
$\frac{A}{2}$=Area controlled by hole E
Then let D_a, D_b, D_c, D_d & D_e=Depth of Ore controlled by holes A,B,C,D and E separately
V_a, V_b, V_c, V_d & V_e=Volume of Ore controlled by holes A,B,C,D and E separately
T_a, T_b, T_c, T_d & T_e=Tons of Ore controlled by holes A,B,C,D and E separately
M_a, M_b, M_c, M_d and M_e=Tons or ozs. of metal controlled by holes A,B,C,D and E separately
From which
(1) $D_a=\frac{8d_a+d_b+d_d+2d_e}{12}$, $D_b=\frac{8d_b+d_a+d_c+2d_e}{12}$, $D_c=\frac{8d_c+d_b+d_d+2d_e}{12}$
$D_d=\frac{8d_d+d_a+d_c+2d_e}$ And $D_e=\frac{4d_e+d_a+d_b+d_c+d_d}{8}$
(2) $\frac{AD_a}{8}=V_a$; $\frac{AD_b}{8}=V_b$, $\frac{AD_c}{8}=V_c$, $\frac{AD_d}{8}=V_d$, $\frac{AD_e}{2}=V_e$
(3) $T_a=V_a\,SpG$, $T_b=V_b\,SpG$, $T_c=V_c\,SpG$, $T_d=V_d\,SpG$, $T_e=V_e\,SpG$
(4) $T_aq_a=M_a$, $T_bq_b=M_b$, $T_cq_c=M_c$, $T_dq_d=M_d$, $T_eq_e=M_e$
(5) $G=\frac{M_a+M_b+M_c+M_d+M_e}{T_a+T_b+T_c+T_d+T_e}$

Fig. 1

these assumptions in mind, to handle the possible cases in prism structure, which may be developed in drill-sampling an orebody.

In each instance where the sampling is by means of churn- diamond- or core-drill holes, or by winzes, shafts,

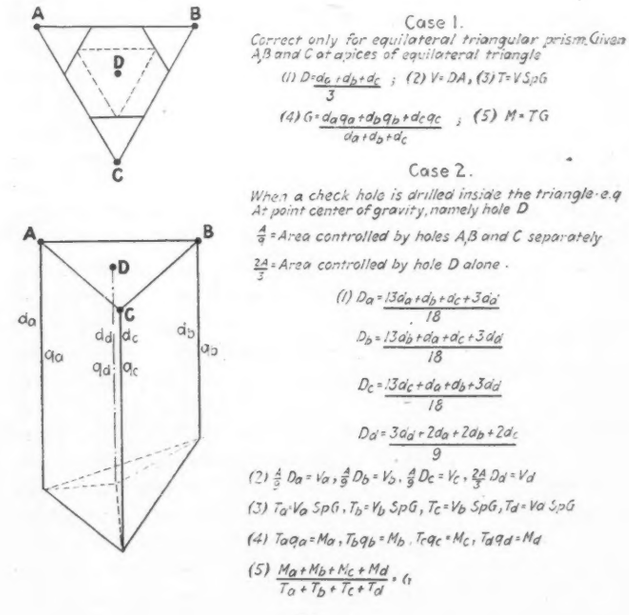

A
B
D
C
Case 1.
Correct only for equilateral triangular prism. Given A,B and C at apices of equilateral triangle
(1) $D=\frac{d_a+d_b+d_c}{3}$; (2) $V=DA$, (3) $T=VSpG$
(4) $G=\frac{d_aq_a+d_bq_b+d_cq_c}{d_a+d_b+d_c}$; (5) $M=TG$
Case 2.
When a check hole is drilled inside the triangle e.g. At point center of gravity, namely hole D
$\frac{A}{3}$=Area controlled by holes A,B and C separately
$\frac{2A}{3}$=Area controlled by hole D alone.
(1) $D_a=\frac{13d_a+d_b+d_c+3d_d}{18}$
$D_b=\frac{13d_b+d_a+d_c+3d_d}{18}$
$D_c=\frac{13d_c+d_a+d_b+3d_d}{18}$
$D_d=\frac{3d_d+2d_a+2d_b+2d_c}{9}$
(2) $\frac{A}{3}D_a=V_a$, $\frac{A}{3}D_b=V_b$, $\frac{A}{3}D_c=V_c$, $\frac{2A}{3}D_d=V_d$
(3) $T_a=V_a\,SpG$, $T_b=V_b\,SpG$, $T_c=V_b\,SpG$, $T_d=V_a\,SpG$
(4) $T_aq_a=M_a$, $T_bq_b=M_b$, $T_cq_c=M_c$, $T_dq_d=M_d$
(5) $\frac{M_a+M_b+M_c+M_d}{T_a+T_b+T_c+T_d}$, G

Fig. 2

or raises, the following nomenclature is used:

d—the depth of the ore in the sample column indicated by the subscript.

g—the figure representing the grade of ore either in per cent of metal, ounces per ton, or cents per cubic yard. Subscript again refers to the column.

D—the average depth of ore in the prism in any appropriate unit.

A—the horizontal area of the prism in square units.

V—the volume of the prism in cubic units.

T—tons of ore in the prism.

Sp G—the specific gravity of the ore in place. Tons per cubic unit.

G—the average grade of the ore in same units as *g* above.

M—Metal: tons of copper, lead, or zinc or ounces of gold or silver.

In Fig. 1 the formulas are those which should be used for a square prism. However, equation (1) is only correct when the four points at the top of the ore and the four points at the bottom lie in the same plane. The condition will rarely, if ever, happen. When the variation from a plane either at the top or bottom is of any importance, equation (1) should be written $D = \frac{2d_a + 2d_c + d_b + d_d}{6}$ taking *A* and *C* as the greater depths.

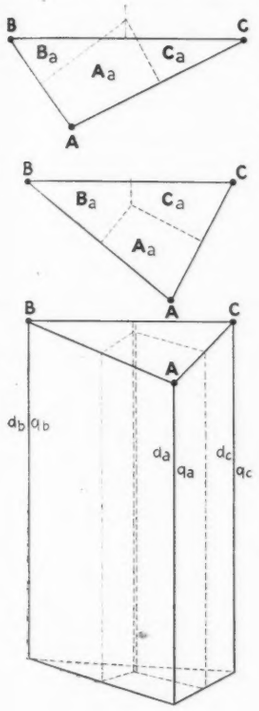
Case 2 is applicable when a check hole is drilled inside a square prism. For instance, to determine the area of influence of the hole *E*, draw perpendicular bisectors of the lines *AE*, *BE*, *CE* and *DE*. Such bisectors will form the diagonal square in Fig. 1 and all ore inside this square, prolonged to the bottom of the prism, will be of the grade of hole *E*, according to assumptions *a* and *b*. The horizontal area of the diagonal square is equal to one-half the area of the large square. The areas controlled by the grade of holes *A*, *B*, *C* and *D* will be only that of the right triangles at the corners of the large square, namely one-eighth of the total area of the large square in each case. If hole *E* were equal only in importance to the other holes in the prism, then it would control only the grade of ore in the small square inside the larger one, in which case much ore would be assumed to be of the grade of hole *A*, *B*, *C*, or *D*, when such ore is much closer to *E*. In this figure equation (1) is the result of solving a somewhat complex calculation. The method of arriving at the value of D_a, D_b and so on is to divide each separate prism into as many triangular prisms as possible, and to average the depths of the triangular prisms. With the separate values of *D* determined, the tonnage of ore and metal in each prism controlled by the different holes is determined, and in equation (5) the total tonnage of metal divided by the total tonnage of ore determines the average grade of the entire prism.

In Case 1, Fig. 2, we have the standard method, previously referred to, under the only conditions for which it is correct. The three points, top of ore, determine a plane, as do the three points, bottom of ore. Each of the three holes control an equal area, and if perpendicular bisectors of the sides of the equilateral triangle are drawn, the figure will be divided into three equal quadrilaterals, conforming to assumption *a* and *b*.

Case 2, Fig. 2, is entirely different. With hole *D* drilled at the center of the figure, the area under its control is represented by the heavy lined hexagon within the triangle, equal in area to two-thirds the total area of the equilateral triangle. The triangle in dotted lines inside the figure is one-fourth the total area and would be the area influenced by hole *D*, in case it were taken as of no more importance in the figure than any of the other holes. For the same reasons outlined under Case 2, Fig. 1, this should not be assumed. The area controlled by holes *A*, *B*, and *C* is in each case only that of the small subtended triangles at the apices of the large

triangle, each equal in turn to one-ninth of the total area of the large triangle. The equations for D_a, D_b, D_c, and D_d are developed in the same way is in Case 2, Fig. 1. After this equations (2), (3), (4), and (5) are easily calculated and we arrive at the grade G of the prism.

In Fig. 3 we have a prism with any scalene triangle as its cross-section. To determine the area controlled by each separate hole, draw the perpendicular bisectors of each side until the bisectors meet in a point. These are represented by the dotted lines in the figure. The ore lying in the area A_a is of the grade of hole A; the ore lying in the area B_a is of the grade of hole B, and the ore lying in the area C_a is of the grade of hole C. The horizontal area of each section may be calculated separately by the use of the formula, but such a calculation is tedious. The work may be simplified somewhat by scaling the lines and areas, as the error introduced in scaling is of no great importance if carefully done on a large map. This method is also equally applicable to Figs. 1 and 2 and will produce exactly the same results. If the method outlined as standard were used in this figure, the influence of hole C would extend more than half way to A and B contrary to assumption a.



Case 1

A, B and C located by co-ordinates forming apices of a triangular prism of any scalene cross section

Calculate length and bearing of lines AC, AB and BC. Also angles ABC, ACB and BAC. From which data lengths of interior dotted lines may be calculated by regular trigonometric formulae. Then calculate by formula: Area = $\sqrt{s(s-a)(s-b)(s-c)}$ etc the areas A_a, B_a, C_a

(1) $D_a = \frac{14d_a + 5d_c + 5d_b}{24}$

$D_b = \frac{14d_b + 5d_a + 5d_c}{24}$

$D_c = \frac{14d_c + 5d_a + 5d_b}{24}$

(2) $A_a D_a = V_a$; $B_a D_b = V_b$, $C_a D_c = V_c$

(3) $T_a = V_a \, SpG$; $T_b = V_b \, SpG$, $T_c = V_c \, SpG$

(4) $T_a q_a = M_a$, $T_b q_b = M_b$, $T_c q_c = M_c$

(5) $\frac{M_a + M_b + M_c}{T_a + T_b + T_c} = G$

Case 2.

When perpendicular bisectors of sides meet at a point outside the figures. Calculate Areas A_a, B_a and C_a as bounded by dotted lines and sides of figure. Then (1) is as follows

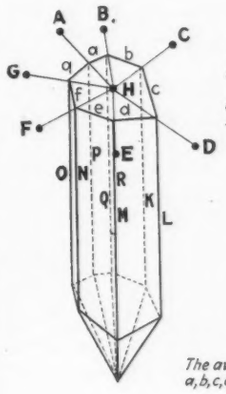
(1) $D_a = \frac{2d_a + d_b + d_c}{4}$, $D_b = \frac{2d_b + d_a + d_c}{4}$, $D_c = \frac{2d_c + d_a + d_b}{4}$

After this, formulae (2) (3) (4) and (5) are the same for case 2 as for case 1

Fig. 3

In Fig. 4 a method is shown which is of general application for asymetrically drilled orebodies. Around any hole a polygon is formed by connecting the center points of lines to the adjacent holes, and each hole forms a separate prism. Also, in the case of symetrically drilled orebodies the result is the same, because in Fig. 1 squares would be formed and in Fig. 2 hexagons would be formed.

The horizontal area may be exactly calculated by formula or closely scaled. D is determined by averaging the depth of all the small triangular prisms which can be formed within the figure. G is g_h and the total tonnage of ore and metal in the prism are found by solving equations (3), (4), and (5).



A, B, C, D, E, F, G, H are asymetrically spaced

Connect the center points of the lines HA, HB, etc to form a polygon - P - with sides a, b, c, d etc.

Let K, L, M, N, etc. stand for depth of ore at vertices of polygon - P - A = Area of polygon and with other symbols same as in previous figures

$a = \frac{AB}{2}$; $b = \frac{BC}{2}$; $c = \frac{CD}{2}$ etc.

$K = \frac{d_h + d_c}{2}$; $L = \frac{d_h + d_d}{2}$; $M = \frac{d_h + d_e}{2}$ etc.

$A = \sqrt{s(s-a)(s-b)(s-c)(s-d)(s-e)(s-f)(s-q)}$

R = Depth ore at H; D = Av. Depth ore-prism

(1) $D = \frac{\frac{7}{2}R + K + L + M + N + O + P + Q}{\frac{3}{2}(7)}$

(2) $V = AD$; (3) $T = V \, SpG$; (4) $G = q_h$; (5) $M = TG$.

From the above we have:

The average depth of any prism of n vertices; depths are a, b, c, d etc. And the formula is

$$\frac{\frac{na}{2} + b + c + d \text{ -- etc}}{\frac{3n}{2}}$$

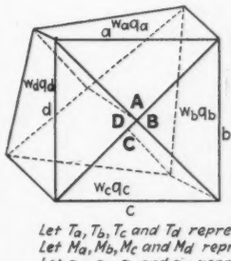
Fig. 4

One of the methods given, I believe, will serve for any prism shape that can be developed from vertical sampling, from drill holes no matter how spaced.

When the tonnage and grade of ore developed in a vein is to be calculated, from drifts running along the vein, with raises driven from one to the other, a different method should be used.

In Fig. 5, we have a square block of ore, and the only question is that of the widths A_w, B_w and so on, which are determined by equation (1). The areas A, B, C, and D are all equal, and the volume in each is in proportion to the widths. With equation (1) solved, (2), (3), (4), and (5) are readily calculated.

Fig. 6 shows a rectangular block developed in the same way as that in Fig. 5. In this case the areas A and B are the same and C and D are the same, but the grade of ore in each instance is controlled by the nearest sampling. These areas are drawn in conformity to assumptions a and b, to comply with which the diagonal planes are bisectors of the corner angles of the block and the center plane joins the junctions of the bisectors. The areas of A, B, C, and D are expressed in terms of l and h and the remaining formulas are derived from the known quantities, to give the tonnage and grade in the block.



A block of ore developed top and bottom by drifts and on ends by raises same distance apart as drifts, forming a square block of side length "l".

By diags. of square divide block into sections A, B, C and D, corresponding to sides a, b, c and d.

Let w_a, w_b, w_c and w_d represent average widths of ore of sides a, b, c and d respectively.

Let A_w, B_w, C_w and D_w represent average widths of ore of section A, B, C and D.

Let V_a, V_b, V_c and V_d represent Cubic Volume of A, B, C and D.

Let T_a, T_b, T_c and T_d represent tons of ore in A, B, C and D

Let M_a, M_b, M_c and M_d represent metallic content of A, B, C and D.

Let g_a, g_b, g_c and g_d represent average grade of ore of sides a, b, c and d.

Then:

l^2 = Total area of block; $\frac{l^2}{4}$ = Area of section A, B, C or D.

(1) $A_w = \frac{5w_a + w_b + w_c + w_d}{8}$ $B_w = \frac{5w_b + w_a + w_c + w_d}{8}$

$C_w = \frac{5w_c + w_a + w_b + w_d}{8}$ $D_w = \frac{5w_d + w_a + w_b + w_c}{8}$

(2) $V_a = \frac{l^2}{4} A_w$; $V_b = \frac{l^2}{4} B_w$, $V_c = \frac{l^2}{4} C_w$; $V_d = \frac{l^2}{4} D_w$

(3) $T_a = V_a \, SpG$; $T_b = V_b \, SpG$, $T_c = V_c \, SpG$; $T_d = V_d \, SpG$

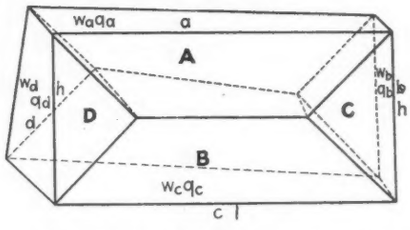
(4) $M_a = T_a q_a$ $M_b = T_b q_b$, $M_c = T_c q_c$, $M_d = T_d q_d$

(5) $\frac{M_a + M_b + M_c + M_d}{T_a + T_b + T_c + T_d} = G$ = Average grade of ore in block.

Fig. 5

If, as might be done, the block were divided by its diagonals, ore would be given to *C* or *D* which property belongs to *A* or *B*.

In Fig. 7 is depicted a form of block which would rarely be encountered. The general method of dealing with such a block is the same as in Fig. 6. In this case we have four triangular blocks, no two of which are equal. The only important matter is to calculate the areas of *A*, *B*, *C*, and *D*, after which the rest of the calculation for *T* and *G*, is simple.



Same case as Fig. 5 except block formed is a rectangle of length l and height h instead of a square. Using same symbols as in Fig. 5.

$$\text{Area } A = \frac{2hl-h^2}{4},\ \text{Area } B = \frac{2hl-h^2}{4},\ \text{Area } C = \frac{h^2}{4},\ \text{Area } D = \frac{h^2}{4}$$

$$(1)\ A_W = \frac{3w_a + w_b}{4},\ B_W = \frac{3w_b + w_a}{4},\ C_W = W_C;\ D_W = W_C$$

$$(2)\ V_a = \left(\frac{2hl-h^2}{4}\right)\left(\frac{3w_a + w_b}{4}\right),\ V_b = \left(\frac{2hl-h^2}{4}\right)\left(\frac{3w_b + w_a}{4}\right)$$

$$V_c = \left(\frac{h^2}{4}\right)w_c;\ V_d = \left(\frac{h^2}{4}\right)w_d$$

$$(3)\ T_a = V_a\,Sp\,G,\ T_b = V_b\,Sp\,G,\ T_c = V_c\,Sp\,G,\ T_d = V_d\,Sp\,G$$

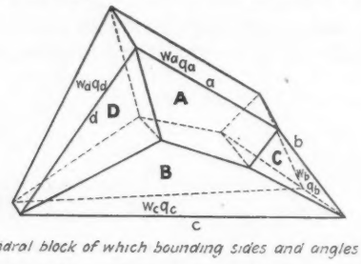
$$(4)\ M_a = T_a q_a;\ M_b = T_b q_b;\ M_c = T_c q_c;\ M_d = T_d q_d$$

$$(5)\ \frac{M_a + M_b + M_c + M_d}{T_a + T_b + T_c + T_d} = G = \text{Average grade of ore in the block.}$$

Fig. 6

The methods of calculation thus outlined have been carefully worked out, and I believe are better than methods generally in use. I was led to evolve them when I found that by properly selecting prisms—that is, by joining holes by selection—I could vary the results for a given orebody, in tonnage and grade, almost at will. Yet the calculations were correct according to the usual method.

No one, of course, would intentionally select high-grade holes to appear more frequently in the calcula-



Any trapezohedral block of which bounding sides and angles may be measured and sampled

Draw bisectors of interior angles and join points of intersection, then from known data calculate lengths of all interior lines and from lengths areas A, B, C and D may be calculated

Then

$$(1)\ A_W = W_a;\ B_W = W_b;\ C_W = W_C,\ D_W = W_d$$

$$(2)\ V_a = \text{Area } A w_a,\ V_b = \text{Area } B w_b;\ V_c = \text{Area } C w_c;\ V_d = \text{Area } D w_d$$

(3), (4) and (5) are then the same as in Figs 5 and 6

Fig. 7

tions than low-grade holes, but sometimes a case arises when there is no choice. One might realize that his figures were being "salted" by the presence of a high-grade hole, yet have no alternative.

What I have been seeking is a method of calculating which eliminates all factors of taste and judgment and rests on pure mathematics. Also, a method which can be handled almost entirely by a calculating machine. I believe the formulas given answer those requirements.

Developments in the German Aluminum Industry

ENORMOUS STRIDES have been made in Germany during the last few years in the development of the aluminum industry. The mineral which still supplies the best raw material for aluminum is bauxite. During the war researches were made in Germany and Austria to discover natural hydrates of aluminum of a similar composition. They were found, in fact, in Dalmatia as well as in Germany, in the latter country especially on the Vogelsberg, in Upper Hessia, and in the Westerwald, in Rhenish Prussia.

At present the deposits on the Vogelsberg are being exploited. The earth found there also contains silicic acid and ferric oxide as well as titanic oxide. On account of these admixtures, the earth cannot be used without treatment for the production of aluminum, which requires a very pure raw material. Therefore the earth is first treated in such a way as to remove these admixtures. This purifying process, however, does not mean an economical disadvantage for the German aluminum industry, as the French product has also to be purified, it containing likewise a certain percentage of SiO_2, iron, titanic oxide and even small quantities of vanadium. By proper treatment a first-class raw material is finally obtained, which is now used.

No less than twenty-one mines are at work in the Vogelsberg district. The German factories work after the Kiliani process. The economical side of the manufacture depends in the first place on the cheap generation of the electric current and secondly on the process itself using as little as possible of the electric energy. The production of one kilogram of aluminum requires about 30 kw.-hr. During the war a number of large aluminum factories sprang up in Germany, and since the close of the war most of them have been considerably enlarged.

Up to the outbreak of the war Germany produced only small quantities of aluminum, about 800 tons per year. All other aluminum was imported. In 1913 a total of 15,323 tons, valued at 25,000,000 marks, was imported, of which 6,000,000 marks-worth came from Switzerland, 4,000,000 from France, 2,000,000 from England, 1,250,000 from Austria-Hungary and some quantities from Norway and America. During the war the large German aluminum works were built, the most prominent among them being situated near Bitterfeld, in the Niederlausitz and near Grevenbroich, in Rhenish Prussia. The Lauta works, in the Niederlausitz, has an annual capacity of 12,000 tons, the Bitterfeld works, of 3,000 tons, and several other works have about the same capacity. The Erft works, near Grevenbroich, in Rhenish Prussia, has a capacity of 12,000 tons per year.

In Bavaria, too, a large plant, the Inn works, is now in process of construction and will be put in operation by the end of the present year. The General Electric Co. of Berlin and the Siemens-Schuckert concern are largely interested in this Bavarian enterprise.

A special sales organization has been formed for all of the works, under the guidance of the Frankfort Metallurgical Society. The production of the works in operation at present amounts to about 30,000 tons per year, and with the Inn works once in operation Germany's aluminum production will surpass 45,000 tons annually. The world's aluminum production in 1918 amounted to about 200,000 tons.

Winter Haulage and the Armstead Snow Motor

A Vehicle with a Unique Method of Propulsion That Has Been Given Some Severe Practical Tests—Useful in Mining Work

By Felix Edgar Wormser
Assistant Editor

THE FALL OF THE YEAR and the first flurries of snow generally turn the thoughts of mine managers to the coming winter and the operating problems it presents. Anyone who has worked in mining camps subject to heavy snowfall, which applies to most of those in the United States and Canada, realizes the serious situation that confronts mine managers, for one thing, in the transporting of men and supplies in winter. Often a mining enterprise has had to be abandoned completely in the cold months because of inability to maintain the communications between mining camp and outside world so essential to efficient operations. The spectacle of teams floundering in the snow, the handicap of slow progress with sleds, and the costly task of keeping roads open generally fall to the lot of even those mines that can continue with their work.

Many inventions have been patented to solve this problem of transportation over snow and ice. Some of them rely upon spiked sprocket-wheels which grip the road in the rear of the sled; others have aeroplane propellers. Caterpillar tractors are also used as a motive agency. In the last three years a new and ingenious type of "snow motor" has been tested in various parts of the country, and the successful weathering of these trials augurs well for its introduction in the arduous work of winter mining. This machine was invented by F. R. Burch, of Seattle, but the patents covering it are now owned by Colonel H. H. Armstead, a mining engineer of New York. An accompanying side view shows its appearance and the propelling device used. The body of the car resembles that of the ordinary automobile; in fact, it contains a similar gas engine (55 hp. Liberty motor in the one shown), transmission gears, and chassis. It rests upon a 4-in. steel tube with trunnions placed between the driving drums so that they can have motion around the tube. The drums have a curved supporting truss which preserves their alignment and gives them vertical flexibility as indicated on the photographs (Figs. 3 and 4). The leading bobsled runners are also jointed to provide easy riding and flexibility. No springs are required, as the machine glides evenly over the smooth snow.

Propulsion is accomplished by four egg-shaped drums occupying the relative positions of the four wheels of the ordinary motor car. The drums operate on the principle of the screw and consequently furnish a powerful method of locomotion. They are directly driven by chain and sprocket connected with two central transmission shafts which, in turn, are driven by one main shaft through the action of gears located in the rear of the machine. (See Fig. 3.) The two drums on one side of the snow motor have right-hand flanges or "skates" spiraled and bolted upon their surface, whereas the drums on the opposite side use left-hand "skates." Hence the two pairs of drums must be and are rotated in opposite directions to give motion to the car. This method of construction enables the snow motor to take a positive grip on the road, preventing it from slipping forward, backward, or sidewise. The flanges are set at an angle of 29½ deg. to the axis of the drum and are 1¼ in. high. The drums are so spiraled that three of the skates on each engage with the road at any instant, and consequently the tractive effort of

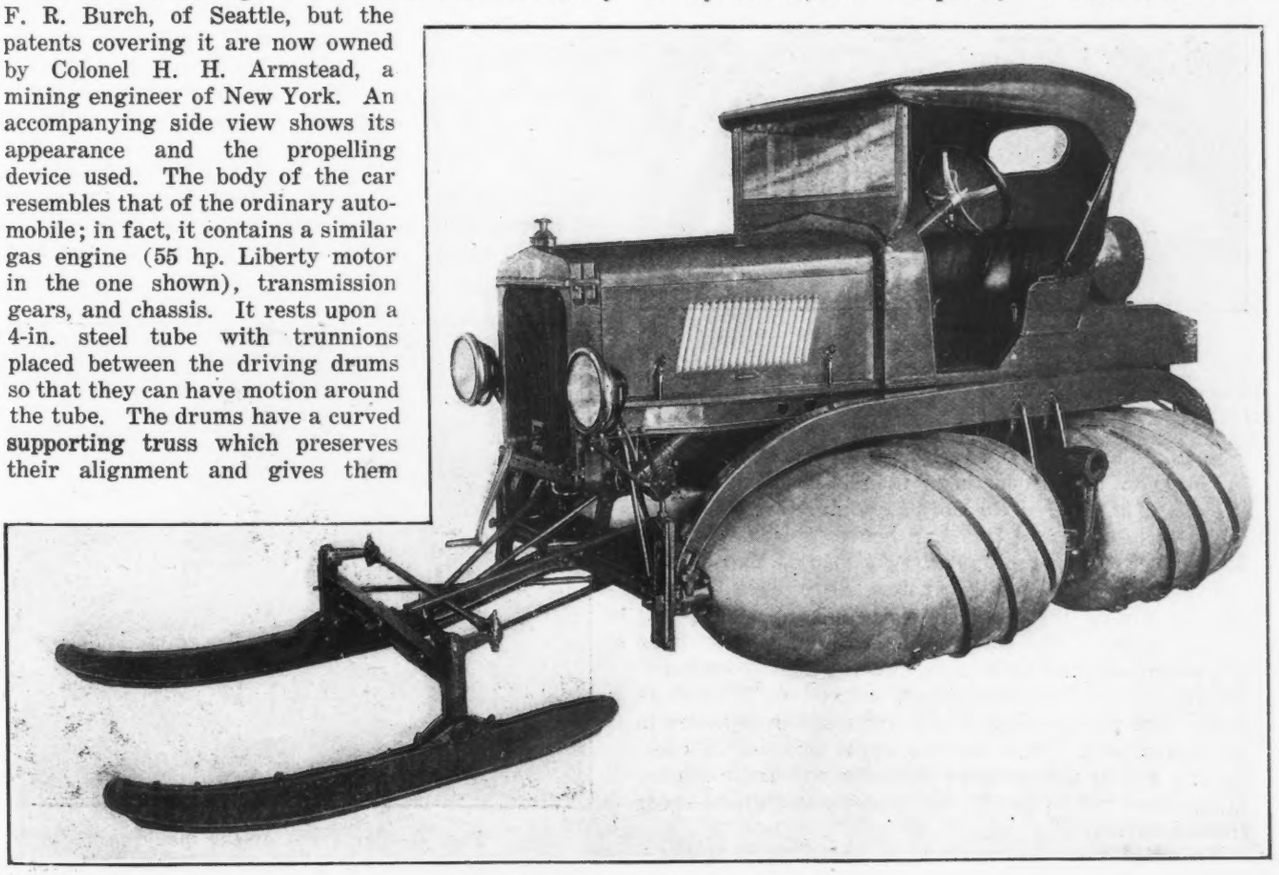


Fig. 1—The completed machine

This view shows the general arrangement of the snow motor units. Note its compactness. Four steel drums are the propelling agents

twelve skates is given. The drums were originally constructed of aluminum and the flanges of steel, but the designers contemplate making drum and flange integrally out of pressed steel.

During the last three years the snow motor has been quietly subjected to many tests to determine its ability in actual working conditions. At the camp of the Collins Lumber Co., Pine Lake, Wis., it was used ten days in logging operations and handled larger loads than the teams. In one special test four sleds bearing logs estimated to weigh over eighty tons were connected in tandem on a level stretch of road, and the snow motor was used to start and move this cumbersome load.

Another spectacular test was conducted in Ironwood, Mich., in March, 1921, and consisted in hauling nine double bobsleds loaded with 450 men and boys over the streets of the city. The snow motor also demonstrated its usefulness in breaking roads over unpacked snow. The large diameter of the drums furnishes such a wide bearing surface that the machine only sinks about 8 in. in the soft snow, leaving two U-shaped tracks which can be used by any teams following it.

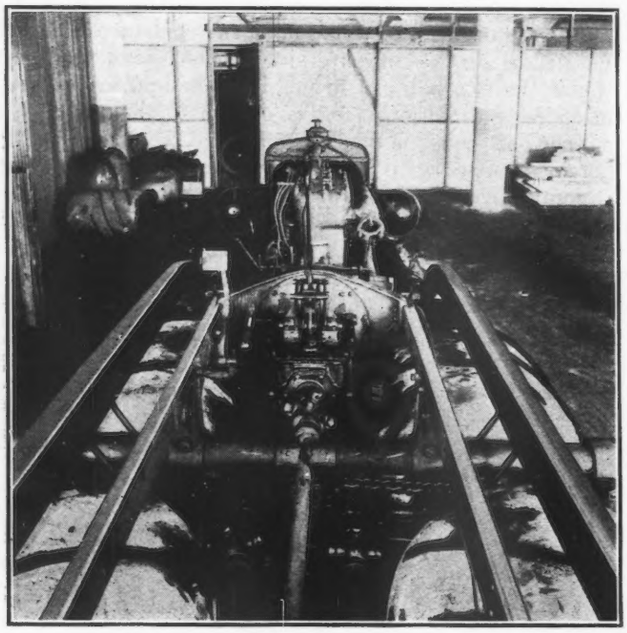


Fig. 2—The chassis

The main shaft in the center actuates the two drum shafts by means of a transfer gear case in the rear of the machine shown in Fig. 3. Each of the drums is driven by a chain from the drum shafts.

In 1920 the Idaho-Continental Mines Co., of Klockman, in the snow belt of northern Idaho, tried out the machine, and it covered the normal 14 mile stretch to the mine at the rate of 7 miles an hour. A sled was later attached to the motor and given a load of five tons of concentrate—subsequently increased to seven tons—without taxing the capacity of the motor.

The speed of the machine depends, of course, upon its design and the conditions under which it operates. On flat icy surfaces it has made a speed of 23 miles an hour. The performance of the Armstead snow motor in its preliminary trials shows a great promise of overcoming one of the greatest obstacles to winter mining in the snow belt of the United States and Canada—poor transportation.

The ability of the machine to break roads opens a field of usefulness that should not confine its application

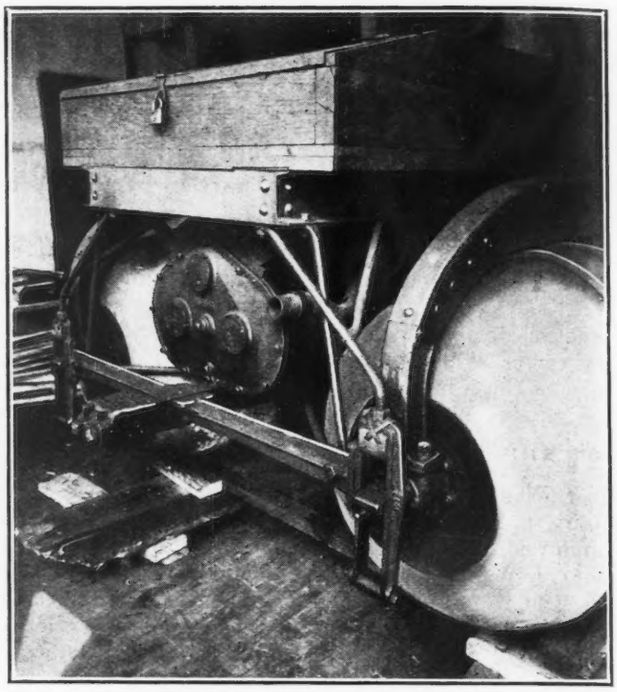


Fig. 3—The rear of the machine

Note the transfer gear case and the guides for the drums permitting vertical movement. Rear drums are blunter than front ones.

entirely to mining and industrial enterprises. Communication over snow-blocked roads should be rapidly re-established by the use of the machine, without the costly handling and removal of any snow. This is a most important consideration for cities and towns in snowy areas. Immediately after a storm, the snow motor can be run over the blocked stretch to provide a road with tracks 18 in. wide, 57½ in. center to center, permitting horse-drawn or gasoline propelled vehicles to follow at once. A double road or one with turn-outs could also be made without delay.

Machines are now being built in Detroit by the Armstead Snow Motors of the United States, Inc., under the management of A. F. Knoblock, who has been prominently identified in the automotive industry for many years.

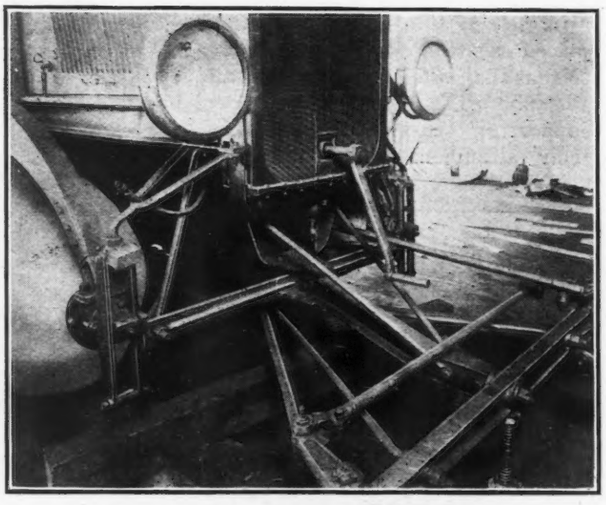


Fig. 4—The front of the machine

The steering mechanism and the guides for the drums furnish the snow motor with sufficient flexibility to attain practicable operation

Recent Mexican Mining Decrees

A Translation and Review of the Mine Tax Franchise Law Promulgated on June 29, 1923

By Paul X. Stoffel

THE MEXICAN mine tax law of June 27, 1919, now in force, provides three kinds of taxation covering mining properties and mining activities:

The mining property tax.

The mineral production tax.

The mint tax (smelting, coinage and assay tax).

The annual mining property tax is levied in the following manner:

The tax is to be paid in advance, each third of the year; that is to say, during the months of January, May, and September. The unit on which taxes are to be met is the *pertenencia* or hectare (2.47 acres) or fraction thereof. Any fraction of any *pertenencia* is considered, so far as fiscal considerations come into play, as a full *pertenencia*. Thus, for example, a title covering a mining claim containing an area of 12.4600 hectares is taxed as containing 13 *pertenencias*.

The annual mine tax on mining property is progressive with relation to the total area taxable and ruled by the following disposition:

From 1 to 5 *pertenencias*, at the rate of $6 Mexican.

From 6 to 50 *pertenencias*, at the rate of $9 Mexican.

From 51 to 100 *pertenencias*, at the rate of $12 Mexican.

Any excess over 100 *pertenencias*, at $18 Mexican.

The progressive taxation extends over all mining properties owned by any one individual or company and located within the circumscription of any one mining agency. Formerly, the territory of Mexico was divided into 145 mining agencies, but with the beginning of 1919 a reorganization plan has been instituted, and at present about 95 mining agencies cover the territory of the republic.

Under date of June 13, 1923, President Obregón signed a new franchise tax law giving delinquent taxpayers certain rights and opportunities. This new decree or franchise law was published June 29, in the "Diario Oficial." The provisions of this law are:

All pending arrears from 1910 to date are pardoned, provided the interested party complies with the following conditions:

Meets the current mine tax (second third of the year 1923), plus a surcharge of 25 per cent of its amount, canceling thus all arrears.

Resumes active operations on the mining claim (title) before Oct. 1, or, if exploitation should have been carried on during former years, the production during the last third of 1923 (October to December) should be equal to at least 20 per cent of the amount of least production obtained during any one third of a year of past exploitation.

This second disposition is simply a repetition of the condition imposed by the law of Sept. 14, 1916, by which the operation of all mining claims in Mexico was required and failure to comply with this requirement subjected the property to be declared void (*caduco*). This law is still in force, but has never been applied, and there is not one case existent of the title to any mining property having been declared void for failure to comply with this law—i.e., to carry on active operations; and it may safely be assumed that this newly repeated requirement will be applied with due discretion.

This new franchise tax law, by the terms of which all arrears are canceled and lost property is restored, provided the current mining taxes are paid, adding a surcharge of only 25 per cent of its amount, has a very wide and important reach. All arrears from 1910 to date are cancelled, even if the corresponding title has been declared void previously (*caduco*) or is pending such declaration. There are from 12,000 to 15,000 mining titles on which delinquent mine taxes are due but which to date have not been officially declared void. Of course, any title having been declared void (*caduco*) previously to this new franchise tax law coming into force, and any such property or part thereof having been applied for again (*denunciado*), such application, either being pending (*en tramitación*) or already titled, will have to be respected and cannot be redeemed under the terms of this franchise tax law.

During the revolutionary period many mining property owners were compelled to leave their properties and in many instances destruction of part or all of the equipment took place. And thus many failed to meet taxes, claiming that they were forced to abandon their properties. Consequently, this franchise tax law gives all such ample means to redeem their lost properties without implying any burdensome requisites. Of course, if any mine owners were compelled to leave their properties at one time or another owing to political disturbances, thereafter failing to meet the annual mine tax and consequently later suffered the loss of their property, it being declared void (*caduco*), and if such property or part thereof has later been applied for (*denuncio*) by third parties, no redress may be claimed, because it is only elementary equity that such new applications should be upheld.

A new application, covering lost mining property (*caduco*), can only be preferred provided the local mining agency is functioning; the lost mining property has been duly tabled during thirty days at the publication board of the corresponding mining agency; the legal requisites for applications (*denuncios*) comprising the publications of the extract at the mining agency and in the "Periodico Oficial" of the corresponding state has been made; the measurements on the ground noted; and the making of the plans and setting of the cornerstones had been complied with. But if all these legal requisites (the proceedings alone at the local mining agency comprising from five to six months) could be complied with, no reason need then keep any legitimate mine owner from obtaining justice.

Thus, it seems, this new mine tax franchise law gives ample facilities to all legitimate mine owners to redeem lost or abandoned mining property, because the payment of the current mining tax (third of a year) plus a surcharge of 25 per cent of its amount, canceling all possible

arrears from 1910 to date, is perhaps the most generous act the Mexican government has given to the mining industry.

It is unnecessary to point out at length that this franchise law is of great political importance. By its liberal terms it kills any reasonable request for restoration of lost mining property due to failure to meet taxes or to political disturbances.

The official promulgation follows:

Diario Oficial, June 29, 1923.

Decree relative to the exemption of all arrears concerning the annual mine tax on mining concessions.

Decree:

Art. 1 All arrears due, as regards the annual mine tax on mining concessions, are exempt of all surcharges, provided:

I Arrears are met with in the form provided for by Article 4.

II Active operations on the corresponding mining concessions are resumed before Oct. 1 of the present year, and, in case exploitation has been carried on in previous years, actual exploitation covering the last four months of the current year be at least 20 per cent of the amount obtained covering the four months of previous operations with minimum production.

Art. 2 Above franchise is extended and covers mining concessions which have been declared void in accordance with the term of Article 51 of the Mining Law of 1909 (25th of November), provided the corresponding perimeter, as a whole or in part, has not been applied for previously to the publication of this decree. Consequently:

I If title to a mining concession has been declared void previously to the publication of this decree:

A Are suspended all effects as regards the declaration of a mining concession being void (*caduco*) as well as the cancellation of the Fiscal Registry of the title, until the interested party has given proof to have complied with the terms of above article, in accordance with the terms specified by Article 8, or until such terms lapses, in case such proof has not been given.

B All declarations as regards mining concessions are void: also cancellations of the Fiscal Registry are considered insubsistent, as soon as proof has been furnished, of having complied with the requisites mentioned under section "A," provided the terms and provisions of Article 8 are compiled with.

C If the above requisites have not been complied with in accordance with the terms and requisites of Article 8, all previous declarations with regard to mining concessions are void and cancellations of the Fiscal Registry are again in force.

II In case title to a mining concession has not been declared void, nor the Fiscal Registry been cancelled previously to the publication of this decree, such declarations are suspended, in accordance with the terms and requisites established by Article 8.

Art. 3 All arrears arising after the first tercio (four months) of the present year are not affected by the terms of Article 1. Accordingly, titles to mining concessions under this prevision are to be treated in accordance with the precepts of the Mine Tax Law of June 27, 1919, its regulations and Article 51 of the Mining Law. Those who have not paid the mining tax covering the second third (*tercio*) of the current year during the month of May may pay the corresponding tax without any surcharge before August first of this year. After this date the surcharges are computed in accordance with the provisions of Article 18 of the referred to regulations.

Art. 4 Payment regarding arrears are to be met in the following manner: A 25 per cent surcharge on the current annual mine tax covering the second third (*tercio*) is levied, by which all arrears are amortized.

Art. 5 Titles to mining concessions are declared void under the following conditions:

I Those who do not make use of the benefit established by Article 1.

II Those, the owners of which have made use of the franchise established by this law, but have not met the surcharge within the ten days of the time limit set, or suspend active exploitation within the mining concession without justified cause. (The cause of suspension must be qualified by the Department of Industry, Commerce, and Labor.)

Art. 6 Owners of mining concessions who accepted the franchise of this law, the transitory articles of the Mine Tax Law of June 27, 1919, and the decrees of July 6 and Aug. 28, 1920, those of Jan. 9 and Sept. 25, 1922, and who wish to reduce the area of their mining concessions in accordance with the terms of Article 52 of the Mining Law:

I Shall comply with the requisite, established by the fraction II of Article 50 of the Mining Laws Regulations, showing ample proof of having complied with them and satisfied payment of the mine tax in accordance with above mentioned transitory articles and decrees.

II Shall pay deferred payments on taxes due with a 25 per cent increase to be reckoned on taxes covering original title.

Art. 7 The administrators of the principal offices of the Internal Stamp Revenue shall accompany their monthly statement regarding receipts provided for by this law, sending one copy to the Department of Special Taxes of the Department of the Treasury.

Art. 8 Proof to have complied with the requisite mentioned under Article 1 shall be submitted to the Department of the Treasury before Jan. 1 of next year, in accordance with special regulations issued by that department. This means if the owner of the mining concession has exploited the mining concession during some of the past years, or before Nov. 10 of the current year, in case exploitation had not been resumed before the publication of the present decree.

Transitory Articles

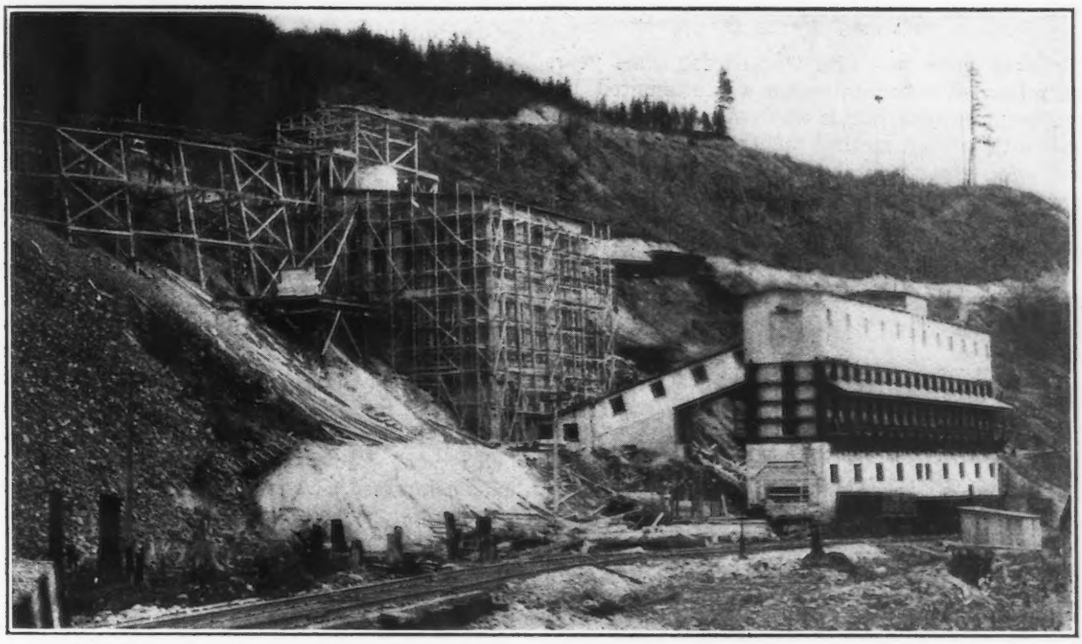
Art. 1 Without prejudicing contents of Article 2 of this decree, the effects of Article 51 of the Mining Law of Nov. 25, 1909, are suspended, as well as the final part of Article 18 of the Regulations of June 27, 1919, with regard to the arrears corresponding to the annual mine tax for any periods previous to the last third (*tercio*) of the present year, such suspension to last until the terms set by Article 8 have lapsed.

Art. 2 Owners of mining concessions who accepted the franchises established by the Transitory Articles of the Mine Tax Law of June 27, 1919, or the decrees of July 6 and Aug. 28, 1920, of Jan. 9 and Sept. 25, 1922, shall continue to meet the Mine Taxes according to above mentioned laws and decrees.

México, D. F., June 13, 1923. (Sig.) A. OBREGÓN.

South African Mines Lack Labor

Mining in South Africa is hampered owing to the decrease in the native labor supply, but the knowledge that the shortage can be remedied by the granting by the government of more favorable conditions as regards recruiting in Portuguese East Africa, makes this adverse factor less serious than it otherwise would be. The premium on gold has been on the up-grade and is now a little over 5s. an ounce above standard value, and although it is a premium much below that of previous years, it is still an important bonus when it is remembered that the output of the Witwatersrand mines in 1922 was about seven million ounces.



New ore-sorting and loading plant at Kimberley

Selective Flotation of a Complex Zinc-lead Ore

Experimental Work of the Consolidated Mining & Smelting Co. of Canada on Sullivan Ore Is Successful—New Mill Erected at Kimberley, and Zinc and Lead Products To Be Shipped to Trail

By George J. Young
Associate Editor

THE ORE of the Sullivan mine, Kimberley, B. C., the most important mining property of the Consolidated Mining & Smelting Co. of Canada, is a variable mixture of zinc, lead, and iron sulphides, with relatively small amounts of gangue, principally calcite and quartz. The lead content varies from 10 to 11 per cent; the zinc from 12 to 13 per cent; the sulphur 30 to 32 per cent; the silver is about 3 oz. per ton; the "insoluble" 4 to 6 per cent; and iron 32 to 33 per cent. The principal minerals present are galena, marmatite, pyrite, pyrrhotite, calcite, and quartz.

The ore presents distinct evidences of a cleat in one direction and a subordinate cleat almost at right angles. It tends to break in irregular-shaped rhomboids and is brittle rather than tough, as it can be broken by a sharp hammer blow. It grinds readily. Fractured surfaces indicate an intimate mixture of fine-grained minerals with bands and streaks of mineral, often conspicuous; the pyrite is more pronounced in these bands, although an occasional band of galena is noticeable. The bands are short, rough threads, which persist for a small space and then fade out, apparently representing a partial segregation, though they do not consist of clean mineral. The ground mass is sphalerite of a dark or ferruginous type.

Some specimens show a preponderance of sphalerite; others, of iron sulphide; and some show a greater proportion of galena. A polished section, Fig. 1, indicates the intimate association of the minerals. There is a tendency for the minerals to assume a microscopic form similar to that shown by "graphic quartz" in pegmatite. The sphalerite or marmatite in the specimens examined appears to form a groundmass in which the other minerals are imbedded as separate grains or as a series of connected grains. Sharp crystalline outlines are conspicuously absent, the outlines of both the sphalerite and galena grains being ragged and containing inclusions which are relatively more numerous in the sphalerite grains. The pyrite and pyrrhotite appear to be closely associated. The gangue grains are in the form of scattered irregular lumps.

The ore does not admit of direct smelting without the loss of the zinc, and the specific gravities of the iron sulphides and zinc are so nearly the same that separation of the two by tabling is impossible. By fine grinding and tabling, a fair proportion of the galena can be separated, but ordinary wet concentration yields indifferent results.

Chiefly due to the large size of the Sullivan orebody and the difficulty of treatment, the economic problem is of more than ordinary interest. For several years the Consolidated has experimented, both on a laboratory and pilot mill scale, on the treatment of this important ore. The more significant stages of this long campaign

are, to the best of my information, given in the following:

The Sullivan mine was first worked for some years as a lead mine. Wet concentration was attempted, but with indifferent success, and it was realized that a complete and satisfactory method of treatment must be developed. An experimental mill of 100 to 150 tons' daily capacity was constructed in 1917 and test runs on a large scale were conducted at Trail, but it was a difficult problem. Laboratory tests indicated that the

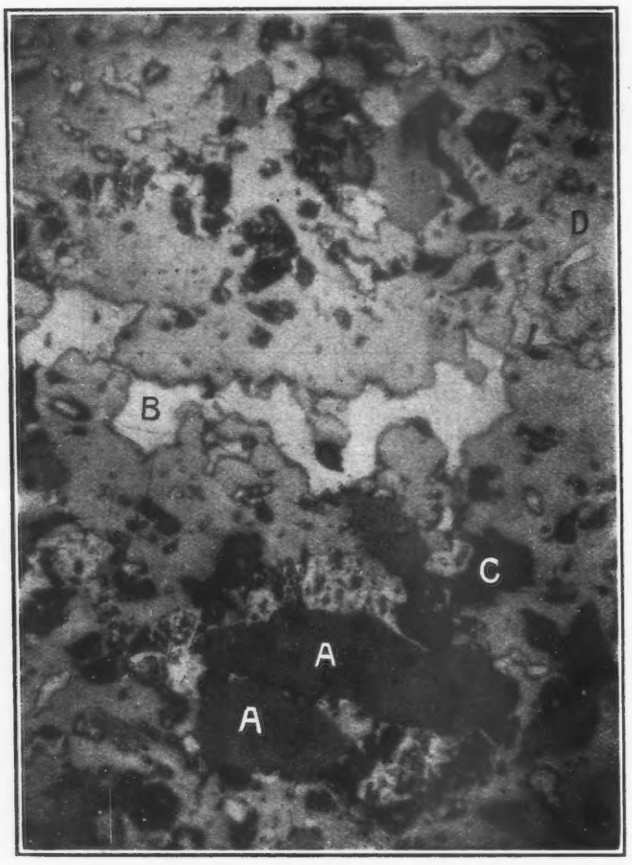


Fig. 1—Polished surface of a specimen of Sullivan ore, × 100

A, gangue; B, galena; C, pyrite-pyrrhotite; D, blende.

Horwood process of separating lead and zinc minerals might be successful, but difficulties arose in the handling of the hot calcine. The treatment costs were high and did not offer much promise of reduction. After eight months' trial the Horwood process was definitely abandoned. The possibilities of gravity concentration were exhaustively investigated, but with little success. The experimental plant was then converted into an experimental flotation plant for treatment of the residues of the zinc hydro-metallurgical plant. The ore was crushed to 1½-in. and ground dry in tube mills to 70 per cent through a 200-mesh screen. It was then roasted and treated in the zinc plant. The roast was not thorough, and some sulphides remained in the roasted product. The tailing from the hydro-metallurgical plant was classified into sand and slime. The bulk of the unroasted sulphide was in the sand, so by regrinding and floating that a high recovery of the contained zinc was made. The method was applied in the test mill to the sand and slime for eight months, and afterward two small flotation machines were placed in the circuit of the zinc plant itself. The net result of this work was an increase in the recovery of zinc in the zinc ore treated in the zinc plant. The experimental mill was shut down in 1918.

A unique method of treatment of the Sullivan ore was discovered by one of the investigators in the research laboratory, and an extension of the test mill, making possible the treatment of 150 tons daily by the method in question, was made. The ore was coarse crushed and heated to between 800 and 850 deg. F. This treatment was found to increase the magnetic properties of the pyrrhotite. When the roasted ore was cooled slowly it retained its magnetic permeability but, on quenching, the permeability was greatly reduced. As a result of the preliminary experiments and in co-operation with the Dings Magnetic Separator Co., a cross-belt type of wet separator was designed and constructed. This comprised a vanner belt 48 in. wide sloping downward. Magnet poles were suspended over this belt, and cross-belts removed the magnetic particles. In effect it was a modified Wetherill separator, the important difference being that wet instead of dry pulp was handled. Six of the machines were made and installed in the experimental plant. By this method the iron sulphides were removed and the lead and zinc sulphides were left. Magnetic separation was followed by table concentration. The 150-ton experimental mill using this process was successful, so it was decided to enlarge it to 600 tons' capacity per day. The proposed enlargement included eighteen magnetic separators.

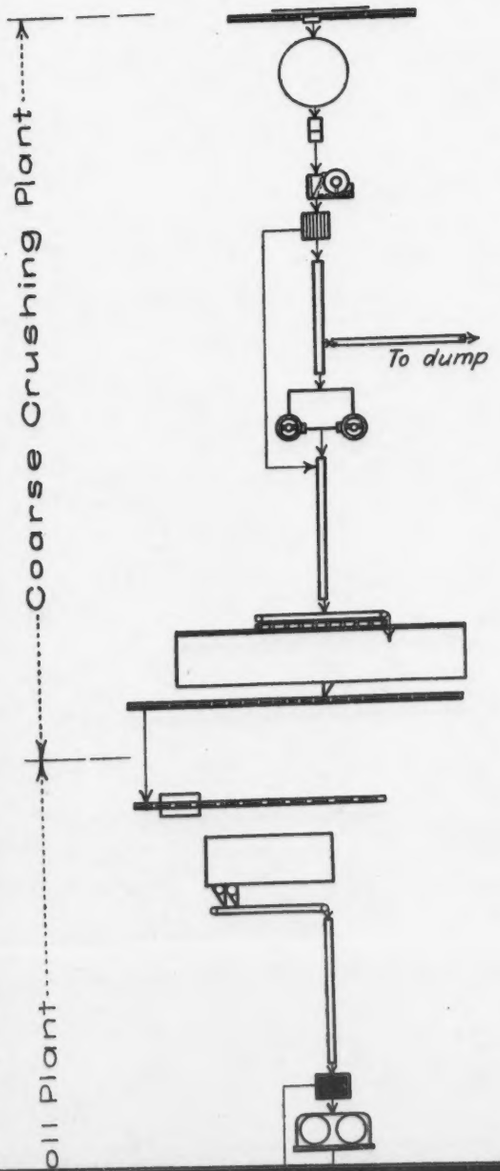
At the time, the spring of 1919, successful laboratory experiments were also carried out in selective flotation. These experiments indicated that three products could be made—iron sulphide and gangue, zinc sulphide, and lead sulphide. The laboratory work was continued and an attempt was made to incorporate selective flotation in the existing plant. Good results were obtained on the lead-zinc product from the magnetic separating mill, but as time went on the experiments indicated the desirability of discarding the magnetic separators. However, difficulty was experienced in duplicating the laboratory results in the larger units, so it was not thought advisable to change the existing plans. The construction of the 600-ton magnetic separation plant proceeded, although the probability of later substituting selective flotation for the magnetic treatment of the ore was realized.

The flow sheet of the magnetic separation plant is shown in Fig. 2. The work in magnetic separation involved no very new principles, though the development of a wet magnetic separator is of considerable interest and great ingenuity was shown in devising and applying new equipment.

The 600-ton magnetic separation plant met unsuspected difficulties. For example, dust and ore fused in the throat of the kiln, forming incrustations and rings. Soon after the 600-ton plant was put in operation the laboratory developments in flotation became so promising that it was decided to convert the original 150-ton experimental mill into a flotation plant. The first attempts of transferring the laboratory methods to a commercial basis were not altogether successful, however. A brass subaëration flotation machine had been used in the laboratory tests. The wooden flotation machines would not give parallel results, but by the addition of copper sulphate to the pulp, identical results were obtained.

Flow Sheet of Sullivan Concentrator, Kimberley, B. C.

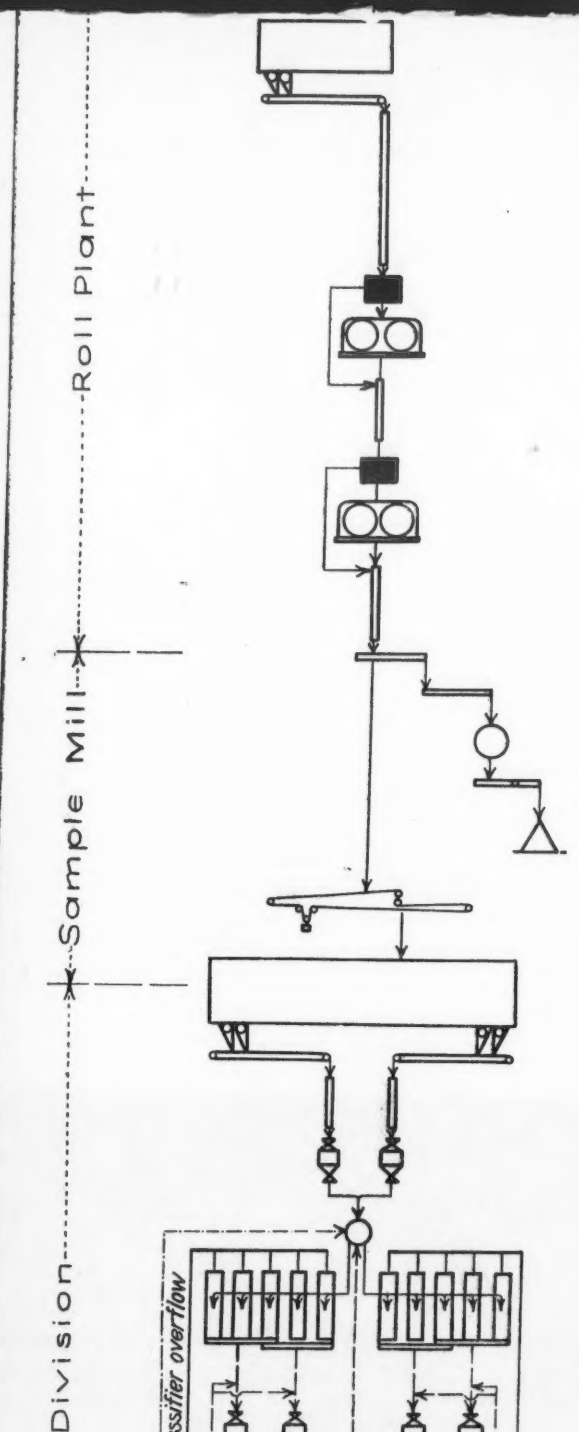
Supplement to "Engineering and Mining Journal-Press," Sept. 15, 1923.
"Selective Flotation of a Complex Zinc-Lead Ore, Pages 453-456"



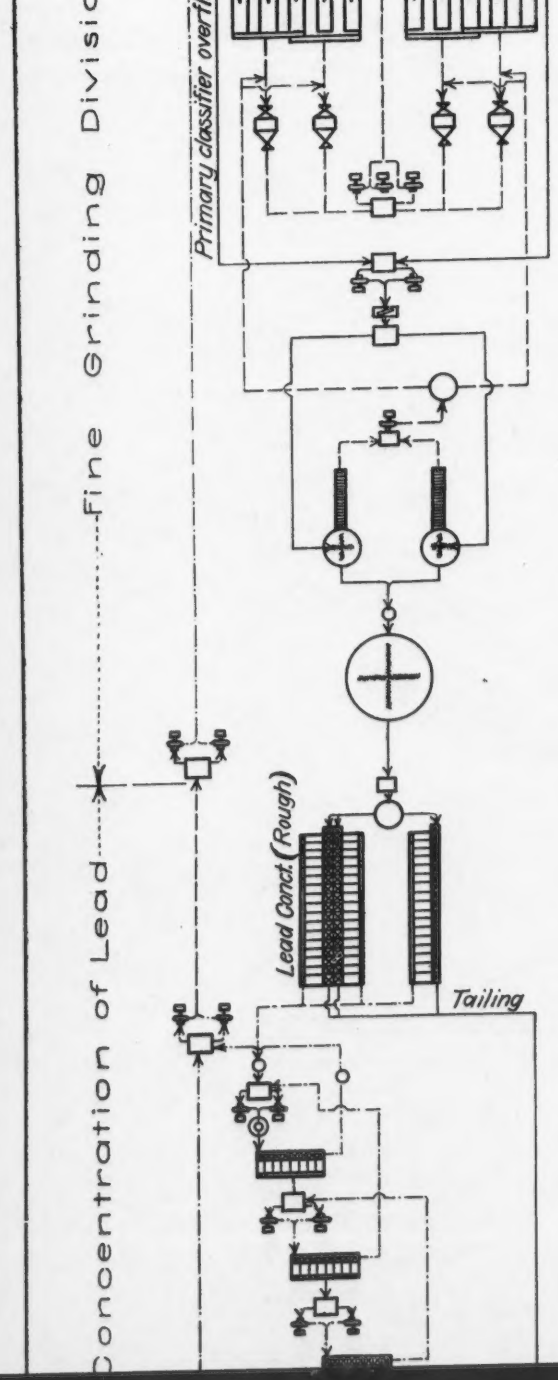
Granby side dump cars; 7½ tons; 36-in. gage; carrying Sullivan ore.
1 1,000-ton circular bin.
1 feed hopper equipped with swinging ore guard and air cylinder for operating ore gates.
1 36x42-in. Type "C" Buchanan jaw crusher, set to 8 in.; 155 r.p.m.
1 bar screen grizzly set to 4 in.
No. 2, picking belt conveyor 42 in.; 7 ply; speed 40 ft. per minute; length 22 ft. 4 in.; slope 3⅞ in. per ft.
No. 3, waste belt conveyor, 18 in.; 6 ply; speed 100 ft. per minute; length 60 ft.; slope 3¼ in. per ft.
2 No. 8 Gates gyratory crushers, set to 2½ in.
No. 4, belt conveyor, 30 in.; 8 ply; speed 176 ft. per minute; length 123 ft. 6 in.; slope 3¾ in. per ft.

No. 5, shuttle belt conveyor, 30 in.; 6 ply; speed 190 ft. per minute; length 61 ft. 7 in.
1 2,500-ton railroad bin.
Chutes to railroad cars.

3½-mile railroad, standard gage.
Railroad cars over 150-ton track scales.
1 1,000-ton ore bin.
20 36x36-in. rotary feeders, 0.57 r.p.m.
No. 6, belt conveyor, 30 in.; 6 ply; speed 155 ft. per minute; length 67 ft.; horizontal.
No. 7, belt conveyor, 30 in.; 6 ply; speed 182 ft. per minute; length 114 ft.; slope 3⅜ in. per ft.
1 5 ft. 3 in. x 2 ft. 3 in. stationary screen; 1½ in. square holes; slope 45 deg.
1 set 72x20-in. Alaska type rolls; r.p.m. 105; peripheral speed 1,980 ft. per minute.



Railroad cars over 150-ton track scales.
1 1,000-ton ore bin.
20 36x36-in. rotary feeders, 0.57 r.p.m.
No. 6, belt conveyor, 30 in.; 6 ply; speed 155 ft. per minute; length 67 ft.; horizontal.
No. 7, belt conveyor, 30 in.; 6 ply; speed 182 ft. per minute; length 114 ft.; slope $3\frac{5}{16}$ in. per ft.
1 5 ft. 3 in. x 2 ft. 3 in. stationary screen; $1\frac{1}{2}$ in. square holes; slope 45 deg.
1 set 72x20-in. Alaska type rolls; r.p.m. 105; peripheral speed 1,980 ft. per minute.
No. 8, belt conveyor, 30 in.; 6 ply; speed 175 ft. per minute; length 45 ft.; slope $3\frac{3}{16}$ in. per ft.
1 5 ft. 3 in. x 2 ft. 3 in. stationary screen; $\frac{3}{4}$ in. square holes; slope 45 deg.
1 set 72x20-in. Alaska type rolls; r.p.m. 105; peripheral speed 1,980 ft. per minute.
No. 9, belt conveyor, 30 in.; 6 ply; speed 190 ft. per minute; length 192 ft.; slope $3\frac{5}{16}$ in. per ft.
1 bucket sampler; sample cut 1 from 100.
No. 10, belt conveyor, 18 in.; 5 ply; speed 65 ft. per minute; length 31 ft.; slope $3\frac{3}{4}$ in. per ft.
1 mixing table; diameter 5 ft. 3 in.; speed 12.5 r.p.m.
1 bucket sampler; sample cut 1 from 100.
Daily mill feed sample to bucking room.
No. 11, belt conveyor, 30 in.; 6 ply; speed 217 ft. per minute; length 133 ft.; horizontal; equipped with automatic traveling tripper.
1 2,500-ton fine-ore bin.
28 36x36-in. rotary feeders; 0.57 r.p.m.
No. 12, 13, 14, 15, belt conveyors, 18 in.; 6 ply; speed 204 ft. per minute; length 38 ft.; horizontal.
No. 16 and 17, belt conveyors, 18 in.; 6 ply; speed 164 ft. per minute; length 38 ft. 6 in.; slope $3\frac{5}{8}$ in. per ft.
Nos. 1 and 2, Hardinge ball mills, 8 ft. x 48 in.; r.p.m. 20.7; charge 40,000 lb. 3- and 4-in. forged-steel balls.
1 10-way mechanical distributor. Agitator, r.p.m. 97.
Nos. 1-10, 6x25-ft. Dorr rake classifiers, model "D"; slope $2\frac{1}{2}$ in. per ft.; strokes 17 per minute.



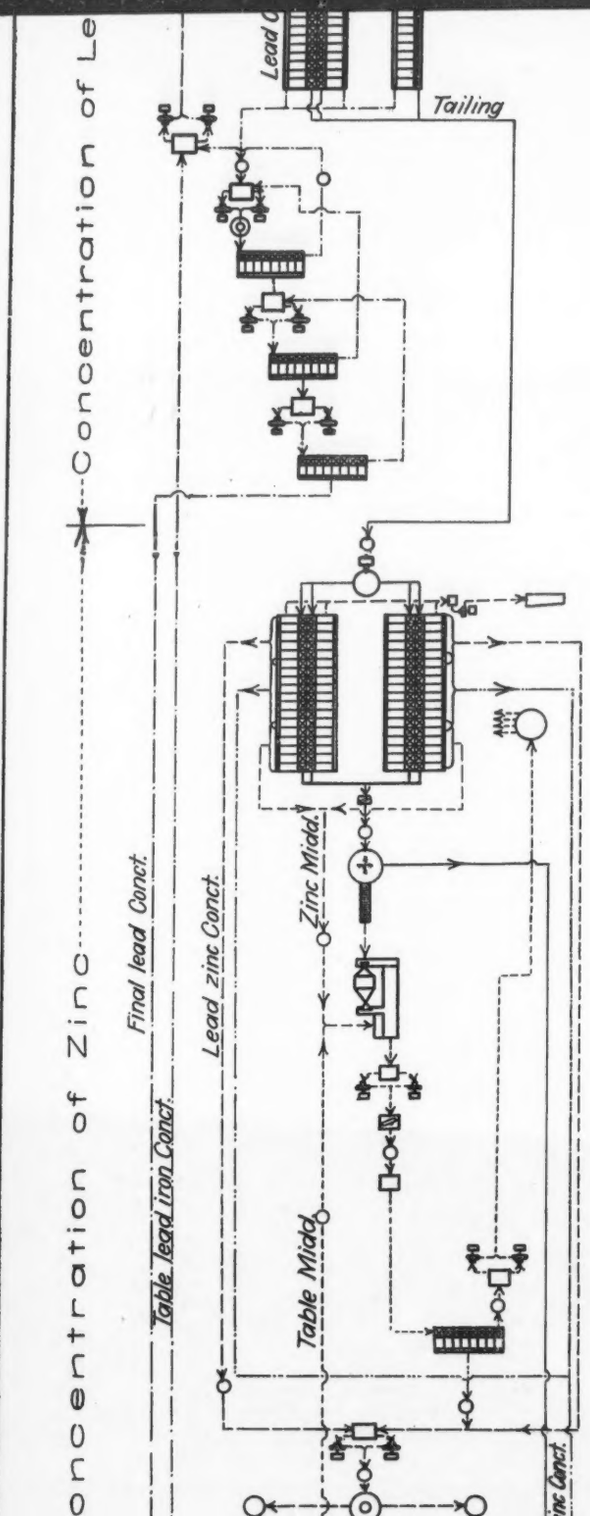
itator, r.p.m. 97.
Nos. 1-10, 6x25-ft. Dorr rake classifiers, model "D"; slope 2½ in. per ft.; strokes 17 per minute.
Nos. 3, 4, 5, 6, 8 ft. x 48-in. Hardinge ball mills; r.p.m. 18.2; ball charge 40,000 lb. 1¾ and 2¼-in. chilled white-iron balls.
Nos. 1, 2, 3, 6-in. Wilfley sand pumps; r.p.m. 860; lift 37 ft. 6 in.
Nos. 7 and 8, 6-in. Wilfley sand pumps; r.p.m. 860; lift 40 ft.
1 manometer pulp density indicator.

1 4-way distributor.
No. 3, 4-in. Wilfley sand pump; r.p.m. 1,150; lift 29 ft. 6 in.
Nos. 11 and 12, Dorr 10-ft. bowl, 3-ft. rake classifiers; slope 2 in. per ft.; strokes 16 per minute; agitator, r.p.m. 1.25.

1 automatic flood sampler No. 1.
1 30x6-ft. mechanically agitated feed stock tank; r.p.m. 5.

Nos. 10 and 11, 4-in. Wilfley sand pumps; r.p.m. 1,150; lift 59 ft.
1 steam box.
1 3-way mechanical distributor.

Nos. 1, 2, 3, primary lead flotation machines; modified 18-cell 24-in. standard M.S.; line shaft speed 450; spindle speed 255.5.
Nos. 33 and 34, 4-in. Wilfley sand pumps; r.p.m. 1,150; lift 42 ft.
1 automatic flood sampler No. 6.
1 automatic flood sampler No. 14.
Nos. 25 and 26, 4-in. Wilfley sand pumps; r.p.m. 1,150; lift 45 ft.
1 feed cone.
No. 10, first lead cleaner, 8-cell 24-in. modified standard M.S. machine; line shaft 450 r.p.m.; spindle speed 255.5.
Nos. 27 and 28, 4-in. Wilfley sand pumps; r.p.m. 860; lift 35 ft.
No. 11, second lead cleaner, same specifications No. 10.
Nos. 29 and 30, 4-in. Wilfley sand



machines; modified 18-cell 24-in. standard M.S.; line shaft speed 450; spindle speed 255.5.

Nos. 33 and 34, 4-in. Wilfley sand pumps; r.p.m. 1,150; lift 42 ft.

1 automatic flood sampler No. 6.

1 automatic flood sampler No. 14.

Nos. 25 and 26, 4-in. Wilfley sand pumps; r.p.m. 1,150; lift 45 ft.

1 feed cone.

No. 10, first lead cleaner, 8-cell 24-in. modified standard M.S. machine; line shaft 450 r.p.m.; spindle speed 255.5.

Nos. 27 and 28, 4-in. Wilfley sand pumps; r.p.m. 860; lift 35 ft.

No. 11, second lead cleaner, same specifications No. 10.

Nos. 29 and 30, 4-in. Wilfley sand pumps; r.p.m. 860; lift 35 ft.

No. 12, third lead cleaner, same specifications No. 10.

1 automatic flood sampler No. 2.

1 steam box.

1 4-way mechanical distributor.

1 pilot table.

No. 9, 4-in. Krogh sand pump.

Nos. 5, 6, 7, 8, primary zinc machines. Same specifications as primary lead machines.

1 4-way mechanical distributor to cells No. 13 on Nos. 5, 6, 7, and 8 machines.

1 manometer density indicator.

1 automatic flood sampler No. 3.

No. 13, Dorr 10-ft. bowl, 3-ft. rake classifier; slope 2 in. per ft.; strokes 15 per minute; agitator, r.p.m. 1.25.

1 automatic flood sampler No. 4.

No. 7, 8-ft. x 48-in. Hardinge ball mill; r.p.m. 18.2; ball charge 40,000 lb. $1\frac{3}{4}$ in. and $2\frac{1}{4}$ in. chilled white-iron balls.

No. 14, 6x25-ft. Dorr rake classifier, model "D"; slope $2\frac{1}{2}$ in. per ft.; strokes 17 per minute.

Nos. 13 and 14, 4-in. Wilfley sand pumps; r.p.m. 1,150; lift 34 ft.

1 manometer density indicator.

1 automatic flood sampler No. 8

1 steam box.

1 automatic flood sampler No. 12.

Nos. 15 and 16, 4-in. Wilfley sand pumps; r.p.m. 1,150; lift 50 ft.

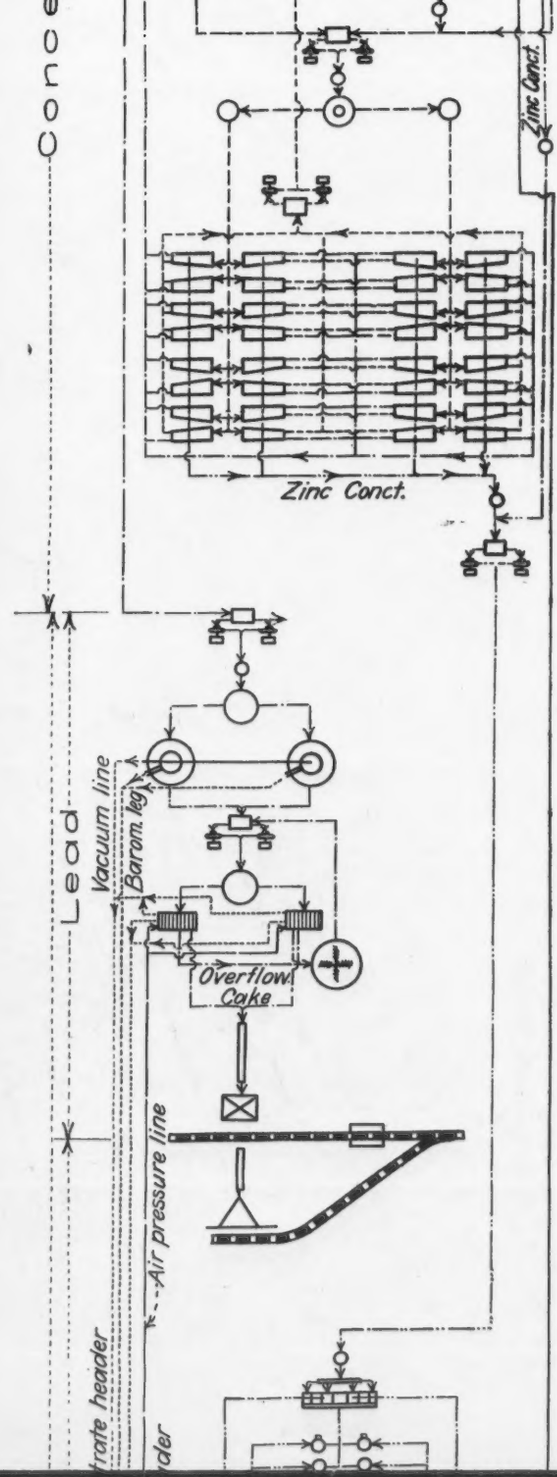
1 automatic flood sampler No. 10.

No. 9 zinc re-treatment M.S. machine. Same specifications as lead cleaners.

1 automatic flood sampler No. 7.

1 automatic flood sampler No. 9.

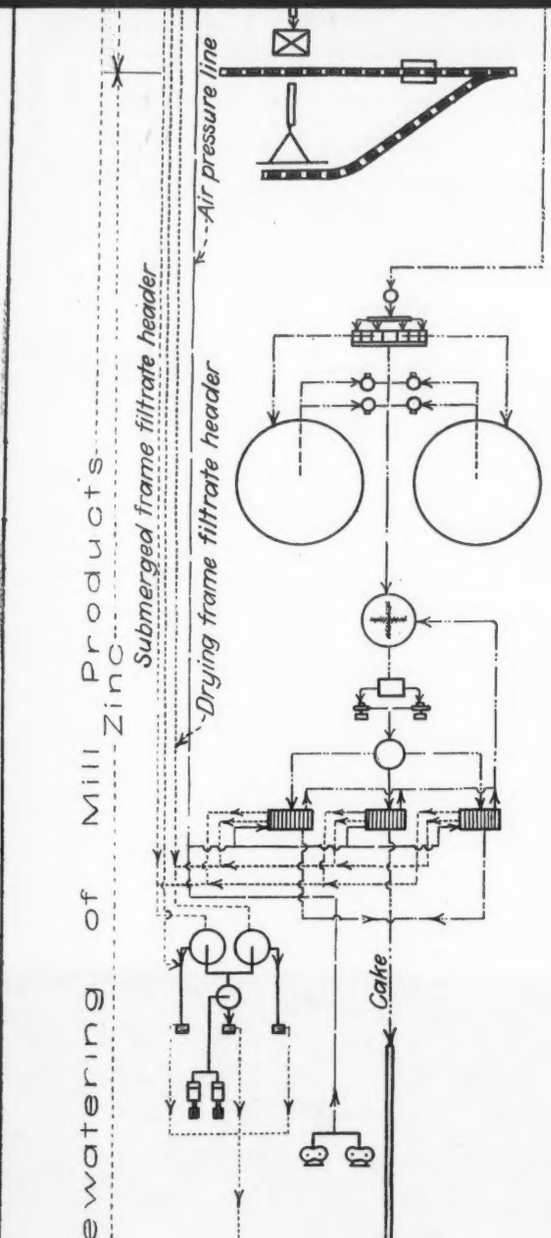
Nos. 17 and 18, 4-in. Wilfley sand pumps; r.p.m. 1,150; lift 50 ft.



cleaners.
1 automatic flood sampler No. 7.
1 automatic flood sampler No. 9.
Nos. 17 and 18, 4-in. Wilfley sand pumps; r.p.m. 1,150; lift 50 ft.
1 automatic flood sampler No. 11.
1 6 ft. 6 in. diam. x 9 ft. 10 in. surge cone.
2 16-way mechanical distributors; r.p.m. 14.
1 automatic flood sampler No. 5.
Nos. 23 and 24, 4-in. Wilfley sand pumps; r.p.m. 1,150; lift 55 ft. 6 in.
24 Plat-O tables and 8 No. 11 D Wilfley tables; 295 strokes per minute.

1 automatic flood sampler No. 13.
Nos. 19 and 20, 6-in. Wilfley sand pumps; r.p.m. 1,150; lift 44 ft.

Nos. 31 and 32, 4-in. Wilfley sand pumps; r.p.m. 1,150; lift 37 ft.
1 automatic flood sampler No. 16.
1 distributing box, steam added.
2 600 sq.ft. "Diamond Stiles" type Genter vacuum thickeners for lead concentrate.
Nos. 35 and 37, 4-in. Wilfley sand pumps; r.p.m. 1,150; lift 37 ft. 6 in.
1 distributing box.
Nos. 1 and 3, 6-ft. diam., 6-disk, 2-valve, variable speed American filters; r.p.m. 0.2 to 0.4; canvas area 300 sq.ft. per filter.
1 20-ft. mechanically agitated lead filter, feed stock tank; agitator, r.p.m. 7.5.
No. 19, belt conveyor, 18 in.; 5 ply; speed 185 ft. per minute; length 185 ft.; slope 115 ft.; horizontal, 70 ft.; 3 in. per ft.
1 50-ton lead concentrator, loading bin to railroad cars.
Railroad cars over 150-ton track scales, to lead smelter at Tadanac, B. C.
No. 21, conveyor, 18 in.; 5 ply; speed 164 ft. per minute; length 75 ft.; horizontal. Stockpile space for 2,500 tons by gravity. Reclaiming track for concentrate to railroad cars.
1 automatic flood sampler No. 17.
1 combination shovel wheel and screen box for zinc Dorr thickener feed.
4-in. Duplex diaphragm pumps, "Tad-



Dewatering of Mill Products
Zinc

speed 185 ft. per minute; length 185 ft.; slope 115 ft.; horizontal, 70 ft.; 3 in. per ft.

1 50-ton lead concentrator, loading bin to railroad cars.

Railroad cars over 150-ton track scales, to lead smelter at Tadanac, B. C.

No. 21, conveyor, 18 in.; 5 ply; speed 164 ft. per minute; length 75 ft.; horizontal. Stockpile space for 2,500 tons by gravity. Reclaiming track for concentrate to railroad cars.

1 automatic flood sampler No. 17.

1 combination shovel wheel and screen box for zinc Dorr thickener feed.

4-in. Duplex diaphragm pumps, "Tadanac" type; r.p.m. 36.5.

2 50x8-ft. Dorr thickeners; r.p.m. 0.5.

1 20-ft. mechanically agitated zinc filter feed stock tank; steam added in stock tank; agitator, r.p.m. 7.5.

Nos. 36 and 38, 4-in. Wilfley sand pumps; r.p.m. 1,150; lift 37 ft. 6 in.

1 distributing box.

Nos. 2, 4, 6, 6-ft. diam., 6-disk, 2-valve, variable speed, American filters; r.p.m. 0.2 to 0.4.

2 5x11-ft. vacuum receivers, 1 each for submerged and drying frames.

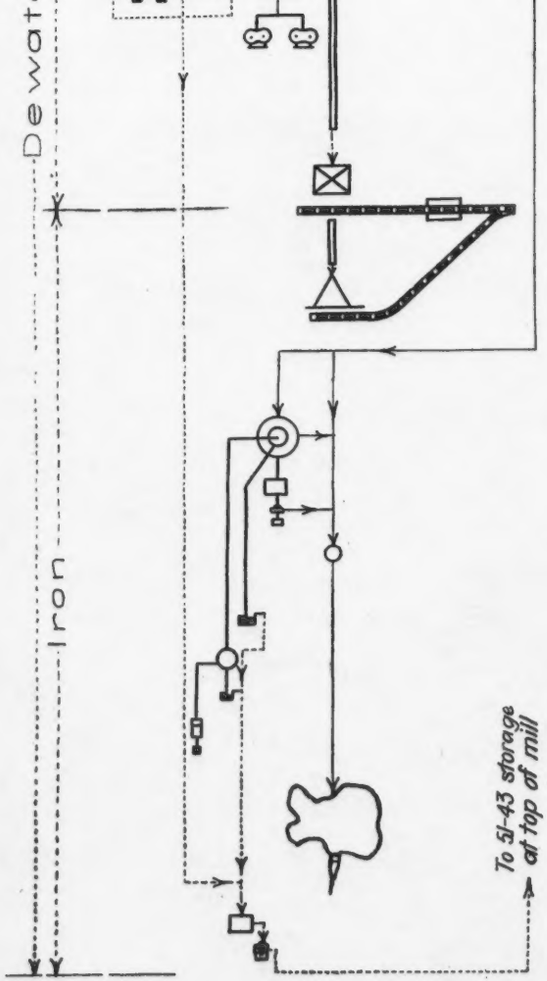
1 vacuum receiver; trap for condensation.

3 barometric legs and water seals.

2 31x12-in., type ER1, Ingersoll Rand vacuum pumps; r.p.m. 220, displacement 2,295 cu.ft. per minute each.

2 14x24-in. Connersville blowers; r.p.m. 330, displacement 1,800 cu.ft. per minute; pressure 5 lb. per sq.in.

No. 20, conveyor for zinc concentrate, 18 in.; 5 ply; speed 185 ft. per



2 14x24-in. Connersville blowers; r.p.m. 330, displacement 1,800 cu.ft. per minute; pressure 5 lb. per sq.in.
No. 20, conveyor for zinc concentrate, 18 in.; 5 ply; speed 185 ft. per minute; length 205 ft.; slope 115 ft.; horizontal, 90 ft.; 3 in. per ft.
1 50-ton zinc concentrate loading bin.
Railroad cars over 150-ton track scales.
No. 22, conveyor, 18 in.; 5 ply; speed 164 ft. per minute; length 100 ft.; slope horizontal. Stockpile space for 2,500 tons, by gravity. Reclaiming track for concentrate to railroad cars.

1 1,200-sq.ft. "Diamond Stiles" type, Genter vacuum thickener.
No. 12, 4-in. Wilfley sand pump, r.p.m. 900; lift 20 ft.
1 automatic flood sampler No. 15.
1 barometric leg and water seal.

1 vacuum receiver. Trap for condensation.
1 barometric leg and water seal.
1 31x12-in. type ER1 Ingersoll-Rand vacuum pump; r.p.m. 220; displacement 2,295 cu.ft. per minute.
Tailing pond; area on dam crest elevation 40 acres.
Approximately 40 years' storage.

1 Allis Chalmers 8-in. 2-stage pump; r.p.m. 1,160; lift 160 ft.

After two months' operation just as good metallurgical results were being obtained by flotation as by treatment in the magnetizing-roasting plant; in addition, the treatment cost was lower and the operations were simplified. The magnetic separation mill was then altered to the flotation system. An extra flotation machine was installed, and about June, 1920, the magnetic separation system was finally discarded. At the time, 600 tons per day of Sullivan ore was being treated by selective flotation.

The ore is ground to 95 per cent through a 200-mesh screen, this being an essential primary condition. The water used in milling is made strongly alkaline and the lead sulphide is separated in a one-to-one pulp at a temperature of 70 to 75 deg. F. (heating is necessary in winter). A one-to-one mixture of water-gas tar and coal tar creosote is the flotation agent used. The lead sulphide froth is subjected to cleaning, the tailing from the cleaner machines being returned to the grinding circuit. Copper sulphate and water-gas tar are added in the second flotation machine, and the blende is separated from the iron sulphide and gangue. The iron sulphide tailing is stored in a pond. I examined the products from the two machines, and must confess to considerable surprise at the apparent cleanness of the lead and zinc products. Both products are suitable as primary material for the lead smelter and zinc acid-treatment plant respectively. The lead concentrate contains over 60 per cent lead and some zinc and iron, the iron approximately a minimum of 7 per cent and the zinc a minimum of 7.5 per cent. The iron is an advantage in lead smelting, and the zinc makes no trouble in the blast furnace, although it is lost in smelting. The use of the Dwight & Lloyd sintering furnaces precludes any objection to the fineness of the concentrate.

The zinc concentrate also contains iron and lead. The lead content is not such as to interfere in the roasting, and the iron, although relatively high, does not materially interfere in the solution of the zinc from the roasted calcine. The zinc content is better than 40 per cent. Both the iron and lead in the roasted calcine are retained in the residues of the zinc plant and are smelted with the lead charge, thus recovering the greater part of the lead and utilizing the iron as basic flux. Both the lead blast furnace and the zinc plant can take care of fluctuations in the composition of concentrates.

The pilot mill utilized two 20-cell Minerals Separation machines in series. The first and last three cells of the first machine were used as mixing cells; the second machine for the separation of the zinc from the iron. The mill was crowded to a capacity of 1,100 tons per day. This required from 80 to 85 men for its operation; total steel consumption was 1.26 lb. per ton for balls and liners, and the power required ranged from 1.25 to 1.3 hp. per ton per day. The tailing approximated 1.8 per cent lead and 2.7 per cent zinc; the feed being approximately 11 and 13 per cent respectively. Grinding in one conical ball mill at a rate of 1,100 tons per day gave 4 per cent of the pulp on a 35-mesh screen and 45 per cent passed a 200-mesh screen. The power requirement for grinding approximated 0.65 hp. per day per ton. One 4-ft., 6-disk American filter was sufficient to handle the lead concentrate, which was discharged at 8.25 per cent moisture, the filter canvas lasting forty-five days.

The specific gravity of the Sullivan ore is approximately 4.4; 1,000 tons of Sullivan ore is equivalent in volume to 650 tons of ordinary ore. Increased capacity for rock crushers, rolls, ball mills and other appliances results from this high density. Bin capacity in like manner is increased per unit volume.

In the preliminary work the Bradford process was experimentally used for cleaning zinc concentrate and retreating zinc middling. The Genter thickener was tested out also, and improvements were made in its construction. The experimental work required two and a half years and was successful in an unusual degree, so that the Consolidated decided to design and construct a 3,000-ton flotation and concentration plant on the basis of the practice so developed. The mill, 3½ miles from Kimberley, is now practically completed and was placed in operation in August.

Outline of New Kimberley Mill

The coarse crushing plant is at the mine and the passage of the ore through jaw and gyratory crushers is made clear from the flow sheet shown in the loose supplement that accompanies this issue.

At the mill the ore is crushed with rolls to pass a 0.5-in. screen and is delivered by a conveyor through a sample mill to a 2,500-ton fine-ore bin. The ore will be bedded in this bin, and also in the 2,500-ton bin at the crushing plant, by shuttle conveyors and traveling trippers. After ball-milling, the pulp is treated by flotation, the galena being separated and then the blende.

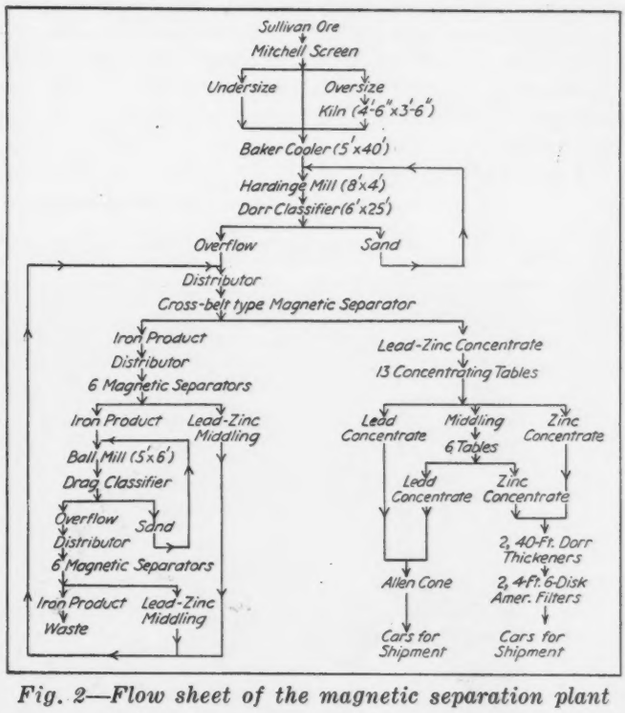


Fig. 2—Flow sheet of the magnetic separation plant

All circulating solutions and sands are handled by Wilfley pumps, and direct-connected motors are used generally throughout the mill. Table concentration is provided for a portion of the zinc concentrate. The final concentrate, after dewatering and filtration on disk filters, will be loaded into sealed steel cars at the lower level of the mill. Shops, storehouses, mill, the roll plant, and the upper and lower tracks will be served by an inclined skipway. All mill floors are served by either electric or hand-operated cranes and crawls. It is expected that eighty-five men will be required per day in the operation of the mill on the basis of 2,000 to 3,000 tons.

The mill scheme is interesting. Crushing, grinding, and sizing follow established practice. The ore storage, totaling 7,000 tons, or 2.3 to 3.5 times the daily capacity, is large, but considering the general situation it is not unreasonable. The system used for cleaning the lead concentrates is novel; evidently the object is to obtain the concentrates as free from zinc as possible, as all zinc shipped in the lead concentrates is slagged and lost in the lead blast furnaces. On the other hand, any lead in the zinc concentrates is saved in the residues of the zinc plant. This is good metallurgical practice.

In detail the method of cleaning the lead froth will be to pass it through three eight-cell, modified standard M. S. flotation machines, in series. The tailing of the first cleaner is sent back to the rake classifier feed distributor; the lead froth to the second cleaner; the tailing of the second cleaner is returned to the feed box of the first cleaner and the lead froth to the third cleaner; the tailing of the third cleaner is returned to the feed of the second cleaner and the final lead froth goes to two Diamond-Stiles type Genter vacuum thickeners, and thence to two disk filters.

The primary zinc flotation machines will make four products: lead-zinc concentrate, zinc concentrate, zinc middling, and tailing. The tailing, middling from the Plat-O tables, and primary zinc middling are reground and returned to the primary zinc flotation cells. The lead-zinc concentrate is tabled (Plat-O and Wilfley tables), the lead-iron concentrate being returned to the rake classifiers, and the table zinc concentrate and primary zinc concentrate being combined and sent to Dorr thickeners. The thickened zinc concentrates are filtered and the overflow from the thickeners is returned to the stock-solution tanks.

The tailing (containing gangue and iron sulphide) from the primary zinc flotation machines is sent to a bowl classifier, the sand discharge of which is ground in a Hardinge mill operated in closed circuit with a rake classifier. The overflow of the rake classifier is passed through a single eight-cell M. S. machine, from which the tailing is returned to the primary zinc flotation machines and the zinc concentrate is sent to the tables. The overflow of the bowl classifier containing the final reject or tailing is sent to Diamond-Stiles type Genter vacuum thickeners, the solution being returned to storage tanks and the thickened tailing being pumped to the waste dump. Thus the tailing is in a closed circuit and can only escape when ground fine enough to pass the overflow lip of the bowl classifier. This is an interesting arrangement and should result in a low zinc content for the tailing.

The mill scheme involves a number of returns and "guards." Its objective is clean lead and clean zinc concentrates and a minimum loss in tailing. It is also interesting to note that in the experimental campaign, selective flotation as applied to this ore has not resulted in producing thoroughly clean lead and zinc concentrates, but it has succeeded in producing concentrates that can be handled satisfactorily by the methods available in the situation. It is not unreasonable to expect that the new mill will give better results than have been obtained in the experimental work.

The members of the metallurgical staff of the Consolidated are to be congratulated on their technical skill in so admirably working out this complex-ore problem. Acknowledgement is made to them for much of the information contained in this article and for courtesies extended. Professor W. S. Morley, of the University of California, very kindly prepared polished sections of the Sullivan ore and the photomicrograph in Fig. 1.

Sharpening Steel Underground Saves Carrying It to the Surface

Blacksmith shop at Mine No. 2 of American Zinc Co., Mascot, Tenn.

Sources and Marketing of Radium

Cheap Belgian Supplies Affect American Industry—Handling of Product Has Its Special Problems

By K. L. Kithil

K. L. Kithil

ALTHOUGH THE mining of radium ores and the manufacture of pure radium salts is confined to comparatively few countries and to a few firms, the United States has heretofore enjoyed first place in the production of this precious element. This condition, however, has undergone a change of late, inasmuch as Belgium has become the chief producer of radium on account of the discovery of fairly large rich ore deposits in its colony, the Belgian Congo in South Africa. These new deposits were found in the well-known rich copper district of that country.

Irrespective of this change, which necessitated the shutting down of American carnotite mines and radium manufacturing plants, it is of interest to become acquainted with the general situation as to the types of radium-containing commercial ores found throughout the world, and also with some of the more detailed information on the difficulties of this industry, and the complex involvements in the marketing of the finished product when compared with similar industries.

In the earlier days radium extracted from pitchblende produced from the mines at Joachimsthal, Czechoslovakia, was the chief source of the element. This mineral was also found in smaller quantities in the tin mines of Cornwall, England.

Torbernite, a high-grade phosphate of uranium and copper, and autunite, a high-grade phosphate of uranium and calcium, were mined in Portugal, and such ores were treated in France. The mine at Joachimstahl furnished the original material for the discovery of radium by Madam Curié.

The chief source, however, of radium prior to the discovery of the Congo radium ores was found in the deposits of Colorado and Utah, where carnotite—a hydrated vanadate of uranium and potassium—occurs in the sandstone beds of well-defined regions of these states, and it is from these ores that approximately 80 per cent of all the radium produced in the entire world has come.

These ore deposits required much development work and trail and road building, and presented many difficulties in the establishing of mining camps, training of miners and ore sorters, and numerous other problems connected with the opening up of a wild, mountainous, and inaccessible country. During a comparatively few years, however, successful methods of prospecting have been developed and applied; lower-grade ores were recovered and treated by chemical means, and this new industry was developed to a really fine degree which seemed impossible only several years before. Especially when regarded from the point of view of the former exclusive higher-grade ores obtained by hand-sorting from the rim deposits, and also when compared with the occurrences of richer ores in foreign countries, great credit in this respect is due to the engineering forces as well as to the scientific staff which by necessity must be attached with an enterprise producing radium.

Carnotite is chiefly found in the southwestern part of Colorado and the southeastern part of Utah. In recent years development has far enough advanced so that finally the prospecting for orebodies is chiefly done by diamond drilling at 100 suitable geological places to determine their location, extent, and thickness. This is no doubt the best method, provided that water is available. It is, however, a costly operation and requiring great study and careful tests of the cores so produced. The orebody is in general irregular, but often continuous, varying in thickness from a knife blade to a few inches, and at times reaching a thickness of two feet where lower-grade ores are encountered. Thicknesses of six feet and over are often found. The area of each individual deposit also varies greatly, often consisting of small pockets of comparatively few tons to areas of from 500 to 1,000 ft.

The average straight shipping ore which has to be hand-sorted after mining contains approximately 2.5 per cent U_3O_8 and 3.5 per cent V_2O_5, but this ratio of U to V may vary considerably. Mill ores as low as 0.75 per cent U_3O_8 have been profitably treated in suitable mills. This shows that according to the richness of the ores produced, from 200 tons to 600 tons and more of such ore is needed to yield one single gram of radium. (It might be stated here that the present Katanga ores which are being treated in Belgium are fairly uniformly rich, that such ores contain over 60 per cent U_3O_8 and that, therefore, a much smaller tonnage of such ore is required to produce one gram of radium.)

Katanga Ores in Belgian Congo

The main deposit of radium ores in South Africa is located at Chinkolobwe (Kasolo) in the Belgian Congo, and is of vein origin but shows the minerals in irregular veins, seams and pockets. The vein material is generally surrounded by copper and uranium minerals such as torbernite. The country rock is sedimentary and represents the same general metamorphism of their copper deposits, a shale. The mining there has been mostly done so far by open-cut methods. The mineral found is uraninite (pitchblende) and its alteration products of oxidation, the principal varieties being distinguished between black, green, yellow, and orange, and the ore produced has been shown by analysis to contain the following minerals:

1. Pitchblende (primary mineral oxide of uranium) and alteration minerals.
2. Torbernite (uranate of copper and phosphorus).

3. Curite (lead uranate).
4. Kasolite (silica uranate).

These minerals are represented in the deposits in various proportions showing a variable content of U_3O_8. At present, however, only high grade ores especially selected are being shipped to Belgium.

Testing of ores is best accomplished by an alpha-ray electroscope, and these tests are made by checking up the ore to be tested against standardized samples of the same kind of ore. Full description of the procedure of such tests can be found in many publications.

The processes used in the extraction and recovery of radium from its ores are well known and have been repeatedly described in the literature referred to above. It required, however, considerable research and intelligent plant control to extract and recover the values of so minute a quantity of radium as is contained particularly in low-grade ores.

Carnotite Cannot Compete with Katanga Ores

Heretofore carnotite has had the advantage over other ores, as it contains also vanadium, which is recovered from these ores in radium manufacture as an auxiliary product, so that no other low-grade ores can ordinarily compete with the carnotite of this country. High-grade uraninite of pitchblende ores can compete, but prior to the discovery of the Katanga deposits such ores furnished only a small percentage of all the radium produced in the world, for the reason that all other pitchblende deposits have shown only a comparative small tonnage of these high-grade ores.

So long as high-grade ores from the Congo can be obtained, it is doubtful that our carnotite deposits can be further exploited, and it was good policy for some of the American radium manufacturing concerns to contract with the Belgians for their supply of radium and to discontinue their mine and plant operations until the South African supply becomes exhausted, or until such time when the lower-grade ores of Katanga have to be shipped and treated.

The Portugese autunite mines which produced low-grade ores, and which ores have all been treated heretofore in France, have also discontinued operations, as they could not compete with the Belgian radium.

Madagascar has produced a small tonnage of betafite (niobate and titanate of uranium), of which small amounts have been treated in France. These ores, however, are considerably mixed with minerals of the rare-earths group containing thorium and consequently mesothorium, so that they cannot form ideal ores for the manufacture of pure radium salts, unless the betafite is most carefully hand-sorted.

It is difficult to discuss this subject in detail in an article of this nature. However, a fair description of the various processes employed has been outlined in the technical and scientific literature on the subject.

Marketing of Radium Peculiar

With reference to the marketing of radium, it is especially interesting to keep in mind the great and varied purposes and interests which have to be considered. All preparations are sold ordinarily on the basis of government certificates testifying as to the radium content by gamma-ray measurements. This work is carried out by the U. S. Bureau of Standards, in Washington, and at various institutions in Europe. Often, certificates issued by the Curie Institute, Paris, have to be furnished even for radium of American origin. Following measurement, packages containing the preparations and measurement certificate under government seal are delivered direct to the customer.

Radium Preparations Usually Certified

As it frequently occurs that preparations purchased by doctors and institutions are resold, or are to be returned to the laboratories for conversion into some other form of preparation, or for change into different kinds of applicators than originally furnished, such preparations are usually returned through the Bureau of Standards with its official measurement certificate. Great care must be taken in the purchasing or repurchasing of such preparations, as they may contain mesothorium, and it is the mesothorium content which must in all cases be determined. The reason for this is that certain preparations may be either entirely mesothorium or a mixture of the latter and the rarer element, which can be determined only with difficulty by means of the gamma-ray measurement. The reason that the presence of mesothorium in radium preparations is undesirable is because its radio-active life is so much shorter than that of radium. Mesothorium decays to half value in 6.7 years, whereas the corresponding decay period for radium is 1,690 years. When, therefore, both elements are present in quantity in a preparation, the gamma-ray determination includes them both, but after twenty-five years the mesothorium will have decayed almost completely while only 1 per cent of the radium will have disintegrated during the same period.

When radium finally has been produced in purest form—that is: radium salt of a purity of over 90 per cent—it is by no means ready to be put on the market, as all radium salt must be put up in proper form, according to the needs and desires of the purchaser. Therefore, a radium manufacturer is, on account of the comparative newness of the product and its almost exclusive medical uses, forced to maintain a greater number of departments which are ordinarily not to be found in similar industries.

Besides the organization for the mining operation, a technical force of chemists and physicists must be employed for the plant organization, and many skilled working men in the chemical reduction plant have to be especially trained. The plant control alone requires a chemical and physical department of well-trained specialists. The crystallization department, with all its intricacies, has to be well established, and intelligent men have to be especially trained.

An entirely separate department is necessary for the final crystallization and fractionation of pure high-grade radium salts and to the making up of the preparations into the various forms of applicators.

The mechanical department plays also an important role, as most of the many apparatus, applicators, screens, and other accessories for applying radium in the medical world are of special designs which cannot be purchased on the open market. This department further is important, as frequently the individual doctor or operator wants his own ideas incorporated in the apparatus as he himself has developed them for his own purposes. Most of the apparatus and designs of accessories containing this precious element are exceedingly minute and require almost mechanical precision in their manufacture.

The sales department is one of particular concern in the radium business. Here again many important features have become necessary in order to develop the

marketing of the product efficiently. All salesmen have to be especially trained in chemistry and physics pertaining to radium, and must have a general knowledge of the equipment to be used for the application of radium in the various branches in radium therapy and must also be able to give information and advice as to the proper form in which radium is to be furnished to clients. The sales department again is also in direct connection with the medical department, which must be maintained by radium companies to correlate in the work of the medical profession.

The service which has to be given to the profession by the radium producers consists also in collecting hospital reports, the description of new instruments and accessories, forms and types of applicators in which the radium is incorporated, and the making up of the special devices developed and designed by the individual doctors for special purposes. All data regarding new technique, methods of treatment, and dosage, have to be collected, and monthly reports are furnished to the radium therapist enabling him to keep informed with reference to the advance and progress in radium therapy. These publications contain information brought up to date, abstracts of special data, lectures, and dissertations calculated to prove helpful in furthering the work of radium uses.

Special lectures and instructions on the chemical and physical properties of radium are given by the various companies producing radium. To entrants into this field of therapeutics, medical information and instruction is provided by the companies. These instructions are in charge of medical consultants attached to the organizations. This work on the part of the producing companies has no doubt proved a great help to the marketing of radium and it will have to be continued at great expense until such time when radium is more generally used in medicine. The services rendered to clients, prospective clients, and others interested, however, does not end there. Arrangements are made for them properly to insure the radium while in their possession and provide safety devices for the handling of the radium and its safe storage.

Instruments and apparatus have to be constructed and installed for the use of collecting emanation from the radium, and complete training in the manipulation of such apparatus and in the method of measuring of dosages is given to the uninitiated.

Radium in the earlier part of its history was sold at as high as $160,000 per gram of radium element content. Later, when the United States began to produce radium more regularly, a price of $120,000 per gram was generally obtained, but the price finally dropped during the last few years to about $110,000 and as competition became keener, and greater amounts were produced in the individual factories, radium sold at $100,000 to $105,000 per gram. Occasionally sales of larger single orders were filled at prices lower than $100,000 per gram.

Since Belgian radium came into the market a world's price of $70,000 per gram of radium element was adapted as a base price for pure high-grade radium salts with an additional charge for small quantities according to containers and distribution in needles, tubes, or plaques. This final drop in price was due to lower treatment charges on account of the very high-grade Congolese radium ores found.

From best records and official statements obtained, and partly from private information available, it appears that there have been produced in the entire world up to the end of the year 1921 approximately 182 grams of radium calculated as element. Over 80 per cent of this amount was extracted from American carnotite ores. About an equivalent of 8 grams of radium element is represented by carnotite ores that were exported in former years for the extraction of radium from such ores in France and Germany. Of this total amount, 22.47 grams of radium were produced from Joachimsthal, Czecho-Slovakia, pitchblende ores during the period from 1909 to 1921.

Several grams of radium were produced in England from Cornwall pitchblende ores and perhaps some 9 grams in France from the Portuguese autunite.

During 1922 stocks of ore on hand and unfinished materials were treated before completely shutting down American plants, which yielded perhaps about 12 to 15 grams additional radium from carnotite ores.

These figures do not include any radium coming from the Congolese ores treated in Belgium, but such ores have furnished from the time of the opening of the Belgian plant in August, 1922, to March, 1923, about 23 grams of pure radium.

The total amount of radium produced in the entire world to this latter date is approximately 216 grams of radium element at an approximate total value of $23,000,000.

About half a million dollars' worth of radium was consumed for the making of luminous watch dials and for rendering luminous certain military equipment during the war.

According to statistics available, there must be about 120 grams of radium in the hands of the medical profession and medical institutions in the United States and comparatively small amounts at scientific institutions.

It is the opinion of all interested parties that so far as can be foreseen radium will in future years never again be obtained at the present low price.

Research in the use of radium in other than medical lines—for instance, industrially—should be carried on and encouraged. The value of radium in therapy has been established in certain well-classified conditions.

New Mining Industries in Austria

By H. L. Geissel

UP TO SOME TIME AGO, Austria imported considerable quantities of porcelain earth (in 1922 528,000 double hundredweight from Germany and Czecho-Slovakia), but recently the exploitation of extensive china-clay deposits of Upper Austria has begun, and Austria is now able to meet not only the entire home demand but to export large quantities of this raw material. Furthermore, the large mica deposits in the Carinthian valley of Lavant are now also being exploited. Mica has been largely imported from oversea countries, and today Austria is shipping mica to European countries. It is well known that mica plates are largely used in the automobile, graphophone and electrotechnical industries.

The Limberger Industrial & Mining Co. has started the exploitation of extensive deposits of infusorial earth situated near Limberg, in Lower Austria. These latter deposits are the only ones in Austria and perhaps the largest in the whole of Europe. All these industries are of recent date. In the former Dual Monarchy none of these minerals was mined.

Alaskan Affairs

By T. A. Rickard

WHEN the late President first set foot on Alaskan soil, at Wrangel, he stated that he had come as a "prophet of understanding": he desired to promote the goodwill that is based upon a mutually good understanding between the Alaskans and the representatives of the national government. This remark of his gains deeper significance by the sudden ending of his life, for it was the dominant note of his presidency. When he visited Vancouver, on his way home, he delivered a message of friendliness to the Canadian people in terms that were keenly appreciated, and reciprocated. Only a day before the end he released for publication the address he was to have delivered in San Francisco, and in that utterance likewise he suffused his discussion of foreign affairs with a feeling of kindness toward all men, and the governments that represented them. Undoubtedly he did much to further his benevolent purpose by his personal contact with the Alaskans and by the speech that he delivered on his return to Seattle on July 27. That address was, he said, "no more than a preliminary report", but it served to record the impressions gathered during his journeys in the North and his ideas concerning the policy most desirable for the people of Alaska. This preliminary pronouncement of policy had been prepared in consultation with Dr. Hubert Work, the Secretary of the Interior, and Mr. Herbert Hoover, the Secretary of Commerce, so that it may be accepted as embodying the views of the Administration; nor is there any reason to believe that President Coolidge will make any important change in the plans for administering the affairs of Alaska, because, apart from his expressed intentions to continue in the steps of his immediate predecessor, it is fair to suppose that the other representatives of the government who have just returned from Alaska will continue in office with the new President.

IT IS TRUE, our "great northwestern empire" has suffered from "the red tape of departmental regulation and interference," no matter what the bureaucrats at Washington may say, but the magnitude and effect of regulation and interference have been exaggerated sometimes so greatly as to intimidate intending investors. The late President insisted, with some success, that the "problem of Alaska" was the problem of all new regions, and particularly those which are relatively inaccessible; he protested properly against the hysteria that has been allowed to color the controversies arising from competitive exploitation. He expressed vigorous opposition to "a program of ruinous exploitation"; the future welfare of the territory lies in "a citizenship with homes in Alaska, not in investors who are seeking Alaskan wealth to enrich homes elsewhere"—in short, it was home-seekers, not absentee exploiters, that were needed. Apropos of this he mentioned the fact that Juneau is on the same parallel of latitude as Stockholm, and Wrangel on the same as Copenhagen, and that all of Finland is north of 60 deg., the latitude of Seward. To promote the making of homes he proposed to encourage agriculture and to check the wasteful destruction of the resources on which the inhabitants depend for a living, such as fish and forest.

AS FOR the recent loss of population amounting to 15 per cent in the decade preceding the census of 1920, Mr. Harding deprecated a pessimistic interpretation; the loss was anything but calamitous, and was paralleled by other regions in the United States and in Canada. It was due to the upsetting of economic conditions by the World War, and therefore was likely to be only temporary. The decreased production of gold and copper in Alaska since 1916 was due to the same cause, for the war had diminished the purchasing power of both metals and had burned so much of the world's store of liquid capital that money is lacking for exploration in Alaska, as elsewhere. As for coal, the late President referred to the Navy Department's attempt to work the Chickaloon mine in the Matanuska coal field, as "a notable fiasco," and expressed his opinion that the mining of Alaskan coal for export "must await big capital in development and aids in reduced transportation costs." As Mr. Hoover was with him, he may have been told that the intense faulting of the coal seams was an obstacle to successful exploitation, but apparently the Secretary of the Interior did not consider the prospect forlorn, as his Chief said that "time and the normal urging of economic conditions will bring Alaskan coal into its ultimate own."

"THE GREATEST Alaskan industry" is fishing, the products of the sea at the present time being worth more than double those of the mine. The wholesale slaughter of the fish by the canning companies impelled the native Indians to make an appeal to the late President, and he responded sympathetically. Undoubtedly some restriction of fishing is needed, and it can be effected in part by executive order. Forestry conservation and management by federal authority were defended by Mr. Harding, who also outlined the system under which wood pulp is obtainable under lease of forest land to paper manufacturers. As for help to Alaska, Mr. Harding advocated the building of trails and roads, to open up the region and to serve as feeders to the government railroad, which is 467 miles long and has cost $56,000,000. The completion of this railroad promises to be an important factor in the development of the Alaskan hinterland.

AT THE CONCLUSION of his address the late President held forth the expectation that the southeastern part of Alaska, with 90 per cent of the population of the Territory, would "in a very few years" be admitted to statehood. That, of course, would end many of the troubles that now arise by reason of the geographic remoteness of Alaska. To this remoteness is due much of the friction and misunderstanding, to allay which was one of the purposes of the Presidential excursion. Their recent close acquaintance with local conditions will enable the Secretaries of the Department of the Interior and of Commerce to give more intelligent direction to Alaskan affairs henceforth, and, more especially, to ameliorate the handicap of costly transportation, by means of feeders, by land and water, to the government railroad, with the successful operation of which is identified the prosperity of business in the interior, more particularly in the great valley of the Yukon.

USEFUL OPERATING IDEAS

Shaft Plumbing Under Special Conditions

BY C. ERB WUENSCH

It occasionally happens that some old mines have been extensively developed without ever having been surveyed. In an instance of this sort, a mine was developed to a depth of over 500 ft. through a two-compartment vertical shaft. The manway, which constituted one of the compartments, was so badly crowded with miscellaneous pipes and other obstructions, such as spreaders, platforms and clamps which supported the piping, as to be inaccessible for a man carrying any surveying instruments. Indeed, a man did well to "squeeze" himself through some of the "tight" portions of it. There were nine different levels driven from the shaft. The first 200 ft. of the shaft were sunk on the vein. The upper levels were, therefore, drifts extending directly from the shaft. Below the 200-ft. level the vein flattened so that the lower levels, below this depth, had crosscuts driven from the shaft instead of drifts, as in the case of the upper levels. These were approximately at right angles to the drifts.

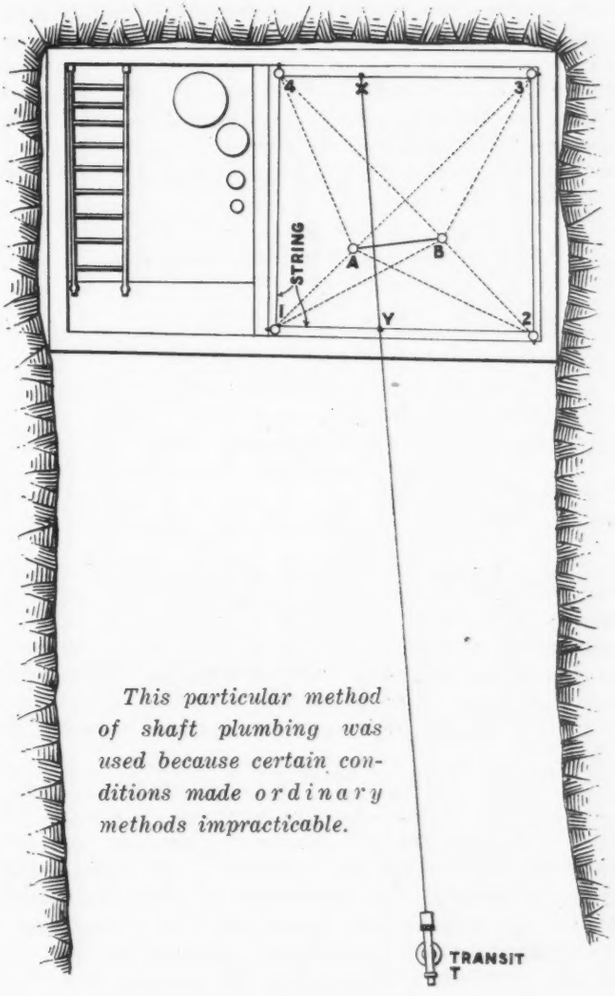
To plumb this shaft by any of the usual methods, the plumb-bobs and wires would have had to be removed from the shaft each time the surveyor wished to go from one level to the next level to be surveyed, because of the inaccessibility of the manway. The only means of access to the various levels, with the surveying equipment, would be through the hoisting compartment, in which a bucket was used. It is obvious that the removal of the wires from the shaft so frequently would take much time, and since the property was in operation, this was to be avoided. To meet the exigencies of the case, therefore, the following scheme was devised by me. Two plumb-bobs were suspended from fine steel wires in the customary manner, precaution being taken to see that they hung freely. The course of these wires was determined from a survey station near the collar of the shaft. The surveyor and his assistant then climbed down the ladderway to the first level. Four small brass screw-eyes, numbered 1, 2, 3 and 4, as indicated in the sketch, were placed approximately in the corners of the shaft as shown. Care was taken to see that they were placed in about the same horizontal plane and also that measurements could be taken from each one to all the others. Care was also used in locating them so that they would not be torn out during hoisting operations.

Measurements were then taken from the various points as follows (see sketch):

1—A	2—A	3—A	4—A	A—B
1—B	2—B	3—B	4—B	
1—2	2—3	3—4		
1—3	2—4			
1—4				

It was necessary that the distance *A-B* should correspond with the distance that the wires were apart at the collar of the shaft. This was a check, of course, as to whether or not the wires were freely suspended in the shaft.

These measurements were made with a small steel tape, which was self-rewinding, and to the end of which a small wire hook had been attached. The hook was inserted into the screw-eye to facilitate taking the measurements. The surveyor called the measured distances to his assistant, who recorded them in the note-book. Later when the computations were made in the office a correction to each measurement was necessary to allow for the constant distance between the hook and the zero of the tape.



This particular method of shaft plumbing was used because certain conditions made ordinary methods impracticable.

Sketch showing position of wires and screw-eyes in shaft

A few narrow planks were laid across the shaft to facilitate taking the measurements as well as to insure safety. This work took about fifteen or twenty minutes at each level. After this was done at each level the plumb-bobs and wires were removed from the shaft so

that the hoisting compartment could again be used for hoisting.

The next step was to take off the meridian at each level. By this time the surveyor and his assistant were able to use the hoisting compartment to take their equipment to the various levels. The transit was set up under a survey plug on the level. A fish-line cord was strung through all the screw-eyes in the shaft and pulled taut, as indicated. Two small knots, (riders) x and y, were placed upon the opposite sides of the tightly drawn string through the screw-eyes. A line of sight was taken to rider x, and rider y was shifted until it also was in the line of sight xyT as shown in the sketch. Measurements were then taken from T to y and also from 1 to y and from y to 2 and from 4 to x and from x to 3. The string was then removed from the shaft. The transit then was sighted to the next station on the level and its position determined with reference to point y. The surveyors then moved to the next level, where the same operations were repeated as have been described.

We were then ready for the office work. The positions of the four screw-eyes were plotted to scale, and with them as points of reference the positions of the wires A and B were determined. The position of points x and y were then plotted. There were thus four triangles $AB1$, $AB2$, $AB3$, and $AB4$. Knowing the length of each side of these various triangles we were able to solve for the angles by use of the following formulas:

a, b and c are the three sides
A, B and C are the three angles.

$$s = \tfrac{1}{2}(a + b + c)$$

$$\text{Sin } \tfrac{1}{2} A = \sqrt{\frac{(s-b)(s-c)}{bc}}$$

$$\text{Cos } \tfrac{1}{2} A = \sqrt{\frac{s(s-a)}{bc}}$$

$$\text{Tan } \tfrac{1}{2} A = \sqrt{\frac{(s-b)(s-c)}{s(s-a)}}$$

$$\text{Sin } A = \frac{2}{bc}\sqrt{s(s-a)(s-b)(s-c)}$$

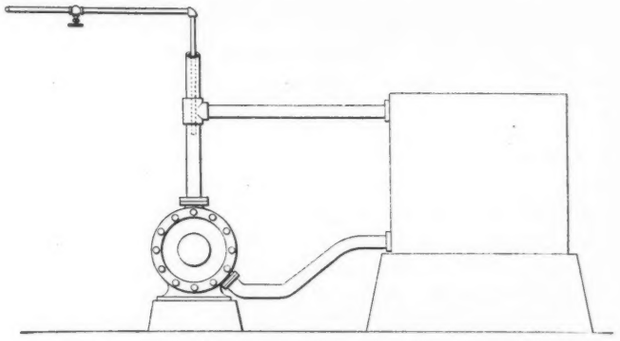
Since we knew these angles and the co-ordinates of points A and B, as well as the sides of the triangles, the co-ordinates of the points 1, 2, 3 and 4 could be calculated. Thence, by interpolation, the co-ordinates of the points x and y were determined. When the co-ordinates of these points had been determined, the bearing of the line xyT could be caluculated by means of the formula: $\text{Tangent Bearing} = \dfrac{\text{Departure}}{\text{Latitude}}$

The above calculations were somewhat laborious. In view of the impossibility of obtaining extreme accurate results because of the small lengths of the sides of the triangles involved, for all practical purposes the course of the line xyT and the position of point y could have been determined with a sufficient degree of accuracy by graphic methods. By plotting the various measurements on a large scale of 1 in. equals 5 ft. or 1 in. equals 10 ft., the angle between lines AB and xyT could be measured with an accuracy of five or ten minutes of arc. This would have been close enough for the purpose. In conclusion, it might be well to state that several connections were made, based upon this survey, and in each instance they checked in satisfactory manner.

Circulation of Thermo-syphon Improved

By Charles Labbe

Last winter an air compressor was installed at a mine plant using a thermo-syphon for circulating the cooling water. When hot weather came the circulation was not as good as it had been, and the compressor ran warmer than it ought for efficiency and proper lubrication. There being no pump at hand, the outgoing pipe was

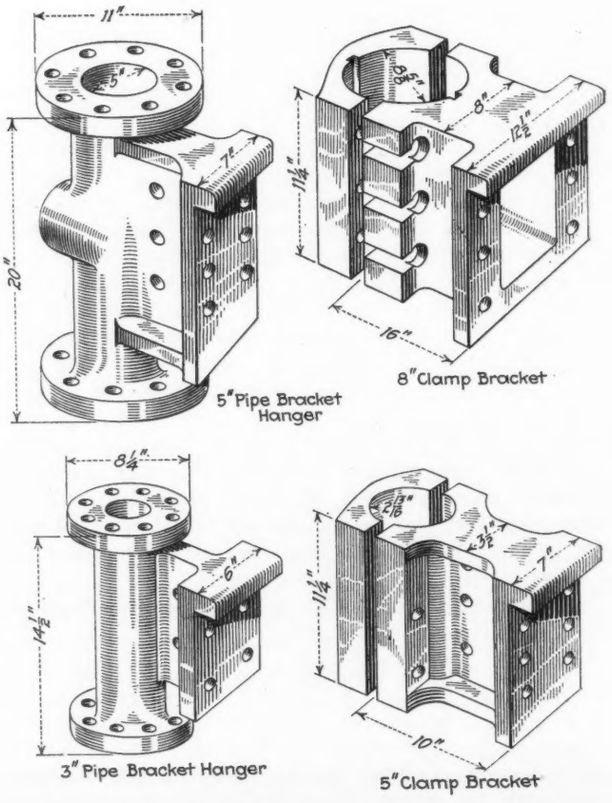


Air lift used to assist thermo-syphon

changed so as to permit the use of a small air lift, which was made of a piece of light copper tubing extending a few feet inside of the water pipe and connected to the compressed air. The amount of air, which is very small, is regulated by a ⅛-in. valve.

Support for Pump Column

The cast-iron brackets and hangers shown in the accompanying illustration were made at the Rosiclare fluorspar mine in Illinois to carry the pump column.



THE PETROLEUM INDUSTRY

New Salt Dome Found by Gulf Production Co.

Fourth To Be Discovered in Ten Years—Texas Fields Showing Effect of Prorating Pipe-Line Runs

A new coastal salt dome has recently been discovered by the Gulf Production Co. in Wharton County. The find was made on Block 14, Missouri Land Co. Subdivision, S. F. Austin League, about eight or nine miles southeast of Wharton, the county-seat. The well is only 475 ft. deep, but positive evidences of the presence of a salt dome have been found. The Gulf Production Co. holds several thousand acres under lease immediately surrounding the discovery well. This is only the fourth new salt dome discovery in ten years, and extends the coastal salt-dome area considerably to the west in the northern part.

Other important coastal developments have been made recently. At Big Hill, Jefferson County, the Houston Oil Co. has completed a 300-bbl. well at 1,800 ft. on the southeast side of the dome. This is the third producing oil well opened here, and indicates that this salt dome will develop into an oil producer of some importance. At Spindletop, Jefferson County, the Rycade Oil Co., a subsidiary of the Dutch Shell Co., has struck some oil in its No. 1 McFadden well as 3,900 ft., but not in sufficient quantity to make a pumper. This field has produced over 40,000,000 bbl. of oil, but practically all from the shallow cap rock. Deep drilling has been carried on for many years, but without success, so that this discovery is of great interest. The Rycade Co. will drill a second well to the southeast of No. 1 well. At Stratton Ridge, Brazoria County, the Freeport Sulphur Co. obtained a showing of oil in its No. 11 Tolar-Dannenbaum well at 4,269 ft. The well will be deepened in an effort to increase the production. Stratton Ridge, a proved salt dome, has been drilled for years, and is one of the few that so far has not produced oil in commercial quantity.

North, Central and West Texas fields are all beginning to show the effects on production of prorating the oil runs. On July 18, the Texas Co. restricted crude oil purchases to 70 per cent of its previous acceptances, and about a month after that cut its purchases to 35 per cent of the pipe-line runs.

The Powell field appears to have passed its peak of production, which was reached late in July with an average daily output of about 110,000 bbl. The completion of several gushers within a short space of time may temporarily increase the present production of about 90,000 bbl. daily, but the big wells now rapidly subside to pumpers, and water has appeared in the northern and the southwestern parts of the field.

At Luling, the youngest field in Texas, the production has increased to 15,000 bbl. per day. The Magnolia Petroleum Co. will erect ten 55,000-bbl. steel storage tanks there.

Report Issued on Pershing Oil Field, Oklahoma

Study of Old Field Reveals Many Facts of Value to Operators in North-Central Mid-Continent Region

The Pershing oil field was developed on two domes, known as the North and South Cochahee domes, in Osage County, Okla. These domes were mapped by geologists of the U. S. Geological Survey when only three wells had been drilled on the North dome and none on the South dome, and the first publication describing them was issued before the South dome had been generally recognized by the oil men. The complete development of the oil field appeared to show both that the work of the Survey's geologists had been very accurate and that the geologic structure was one of the principal factors that determined the shape and size of the field.

This area was then selected for a study of the relations between geologic structure and occurrence of oil by the Geological Survey after the field had been almost completely developed. According to the Survey, if the oil in the Mid-Continent field is ever to be fully exploited it is absolutely essential to find out the conditions that govern its occurrence. It seems obvious that the place to study these conditions is a field where development is practically complete and for which a reasonably full record of operations is available.

The study of the Pershing field was assigned to W. W. Rubey, of the Geological Survey, and Bulletin 751-B, entitled "Progress Report on a Subsurface Study of the Pershing Oil and Gas Feld, Osage County, Okla.," which has just been issued, presents such facts and theories regarding the field as he has determined or outlined to date. The work is by no means complete, but the results thus far obtained are sufficiently important to justify the publication of this bulletin.

Among other facts of interest, the evidence indicates that before the sediments in which oil is now found in the Pershing field were laid down, the Mississippi lime was exposed and was carved into a surface marked by low hills and shallow valleys, and in some places by steep cliffs or bluffs. The significance of this fact is that if the study of well records in this general region indicates an arched or humped surface in the Mississippi lime, the lime is nevertheless not necessarily folded, and the arch so found may not in the least degree indicate a favorable place to prospect for oil.

The study of relations between the productivity and the thickness of the formations in the Pershing field indicates that at least in this field the shore lines, which have been invoked by some geologists to explain the trend of production in parts of the Mid-Continent region, are not a controlling factor. The trend of production in this field is apparently not parallel to the shores of the ancient Cherokee sea in which the oil-bearing beds were deposited; nor is there evidence that the trend of production is controlled by faults.

In the Pershing field, as in many others in Osage County, the most favorable place to drill for oil is not on the crests but on the flanks of the domes. When the field was developed it was found that the crests of the domes were filled with gas and that wells drilled on them did not yield much oil. The largest yield was obtained from wells drilled on the northwest sides of the domes, the smallest yield was from those drilled on the northeast sides. This statement applies only to the larger domes. Wells drilled on or near the minor domes on the flanks of the larger ones were generally very productive.

The possibility that new oil-bearing beds will be found by deep drilling is always in the minds of some operators. In the Pershing field the results of the deep drilling that had been done before Mr. Rubey's work had been completed were discouraging. Twelve wells had been drilled more than 100 ft. into the Mississippi lime, and nine of these had gone more than 300 ft. into it. Several of these wells seemed excellently located to test the possibilities of different breaks in the lime. None of them yielded more than a very small amount of oil, and their failure shows that if there is a deep pool it will be small, probably covering less than a quarter of the area of the pool that was found in the Bartlesville sand.

Over 9,000,000 Bbl. of Petroleum Added to Storage in July

During the July production of crude petroleum in the United States, as measured by the quantity transported from producing properties, attained the new high record of 2,104,742 bbl. a day, according to data reported to the U. S. Geological Survey down to Aug. 27. Daily average imports were 222,419 bbl. and daily average exports of crude oil were 49,800 bbl. Deliveries to domestic consumers increased to the new high record of 1,974,032 bbl. a day. The new supply was greater than the demand by 9,403,000 bbl., which was added to storage. During July 5,524,000 bbl. of California crude oil passed through the Panama Canal en route to eastern ports in the United States. The production of crude petroleum during the first seven months of 1923 was 403,000,000 bbl., as contrasted with less than 318,000,000 bbl. during the similar period of 1922.

The data for 1923 given in the table are subject to revision. For the States east of California the figures, compiled from reports made by pipe-line and other companies to the Geological Survey, show the quantity of petroleum transported from producing properties. Petroleum consumed on the leases and produced but not transported is not included.

Petroleum Production, by States, June and July, 1923

(Barrels of 42 U. S. Gallons)

	June, 1923		July, 1923			
	Total	Daily Average	Total	Daily Average	Jan.-July 1923	Jan.-July 1922
Arkansas	3,079,000	102,633	2,859,000	92,226	19,667,000	7,481,000
California	22,667,000	755,570	25,262,000	814,906	142,652,000	72,108,000
Colorado	5,400	180	4,600	148	40,800	56,500
Illinois	739,000	24,633	745,000	24,032	5,155,000	5,594,000
Indiana:						
Southwestern	70,000	2,333	68,000	2,194	474,000	489,000
Northeastern	20,000	667	19,000	612	134,000	142,000
Total Indiana	90,000	3,000	87,000	2,806	608,000	631,000
Kansas	2,573,000	85,766	2,303,000	74,290	17,412,000	18,783,000
Kentucky	688,400	22,946	612,700	19,765	4,712,500	5,273,000
Louisiana:						
Gulf Coast	193,000	6,433	191,000	6,161	1,320,000	950,000
Rest of State	1,789,000	59,633	1,820,000	58,742	13,621,000	20,498,000
Total Louisiana	1,982,000	66,066	2,012,000	64,903	14,943,000	20,448,000
Montana	207,000	6,900	251,000	8,097	1,537,000	1,179,000
New York	104,000	3,466	110,000	3,580	674,000	573,000
Ohio:						
Central and Eastern	410,000	13,667	420,000	13,548	2,858,000	2,733,000
Northwestern	195,000	6,500	192,000	6,194	1,261,000	1,182,000
Total Ohio	605,000	20,167	612,000	19,742	2,119,000	3,915,000
Oklahoma:						
Osage County	3,440,000	114,667	3,110,000	100,000	23,573,000	22,401,000
Rest of State	12,010,000	400,333	11,575,000	373,387	75,359,000	62,539,000
Total Oklahoma	15,450,000	515,000	14,675,000	473,387	98,932,000	84,940,000
Pennsylvania	629,000	20,967	616,000	19,871	4,330,000	4,242,000
Tennessee	600	20	300	10	2,500	5,800
Texas:						
Gulf Coast	2,511,000	83,700	2,555,000	82,419	17,680,000	20,354,000
Rest of State	6,306,000	210,200	8,107,000	261,516	44,122,000	52,789,000
Total Texas	8,817,000	293,900	10,662,000	343,935	61,802,000	73,143,000
West Virginia	549,000	18,300	542,000	17,484	3,771,000	4,170,000
Wyoming:						
Salt Creek	2,545,000	84,833	3,150,000	101,612	18,057,000	9,854,000
Rest of State	*a* 760,600	*a* 25,353	742,400	23,948	*a* 4,682,200	4,184,500
Total Wyoming	*a* 3,305,600	*a* 110,186	3,892,400	125,560	*a* 22,739,200	14,045,500
	a 61,491,000	*a* 2,049,700	65,247,000	2,104,742	*a* 403,102,000	317,581,000

a Revised

Production of Petroleum by Fields

(Barrels)

	June, 1923		July, 1923			
Field	Total	Daily Average	Total	Daily Average	Jan.-July 1923	Jan.-July 1922
Appalachian	2,381,000	79,366	2,302,000	74,258	16,353,000	16,997,000
Lima-Indiana	215,000	7,167	211,000	6,806	1,395,000	1,324,000
Illinois and Southwestern Indiana	809,000	26,966	813,000	26,226	5,629,000	6,083,000
Mid-Continent	29,197,000	973,232	29,765,000	960,161	193,756,000	184,491,000
Gulf Coast	2,704,000	90,133	2,746,000	88,580	19,000,000	21,304,000
Rocky Mountain	*a* 3,518,000	*a* 117,266	4,148,000	133,805	*a* 24,317,000	15,274,000
California	22,667,000	755,570	25,262,000	814,906	142,652,000	72,108,000
	a 61,491,000	*a* 2,049,700	65,247,000	2,104,742	*a* 403,102,000	317,581,000

a Revised

DISCUSSION

"Engineering and Mining Journal-Press" is not responsible for statements or opinions published under "Discussion." In many cases the views expressed are diametrically opposed to editorial policy and belief.

Scientific Search for Ore

THE EDITOR:

Sir—Mr. Rickard's editorial of Aug. 11, "The Scientific Search for Ore," concerns work in which I am engaged. Perhaps you will permit me to offer some supplementary comment:

The purpose of the work is the improvement of surface information on prospects. The motive is the fact that surface information is cheap. The method is an experimental attack on the surface by technical means.

There is nothing essentially new in this. The method is scientific, but neither more nor less so than that needed in the other tasks of mining geology. It is novel only in its emphasis of leached croppings. And this emphasis is the natural outgrowth of events. So long as ore came by easier ways, there was no need of this one. Now, it and all others must be tried.

This work is, then, merely a detail of mining geology. It has been neglected, and there is hope that it can be made to guide some kinds of exploration at low cost. It is no short-cut to ore discovery. It necessitates more, rather than less, study by the examining engineer. And, except in a limited way, it is not yet ready for application. It is barely initiated. If it is to have important usefulness, the time for it is still in the future. No sudden improvement in ore hunting has occurred, nor is likely to occur. The places of application must be cautiously and narrowly selected by the persons who best know the work.

Nor must it be thought that methods of application have been, or are likely soon to be, standardized. There are divergent methods equally good. C. H. White has chosen one of these, and I another. Mr. White's efforts have an added promise because of their divergence. At this stage we need all the points of view we can get.

Variety in the points of view has, in fact, been afforded by assistance from many sources. For example, the Stanford mining school has promoted the chemical part of the work by providing a laboratory. I wish to commend the willingness of numerous persons, including the editors of the *Journal-Press*, to lend countenance to so experimental a project. And I invite assistance from engineers who may have information pertinent to the judgment of leached croppings. I must say, however, that such information, in order to serve, must be gathered thoughtfully and coldly. Should the project result fortunately, the body of such information already given will require many acknowledgments.

One more comment. Should it result fortunately, it will do so not by displacing other methods but by supplementing them. In so difficult a task as ore hunting, every device is needed and the engineer who remembers croppings and forgets structure condemns himself as lacking the quality of common sense. It will, of course, be acknowledged that no method, however fine, will work without this quality of common sense. Nor need we conclude that the methods of the past have been overburdened with it. For, to our naïve astonishment, orebodies found underground have been repeatedly followed upward until their mappable outlines show at the surface. With the cream of discovery skimmed off, this kind of procedure will no longer serve and a more logical procedure must be developed in its stead. There is plenty to do in the improvement of methods old and new.

AUGUSTUS LOCKE.

San Francisco, Calif.

Weight of Steel Balls

THE EDITOR:

Sir—Referring to the article by Donald H. Fairchild, on page 197 of your issue of Aug. 4, regarding the weight per cubic foot of steel balls, it is noted that he uses the theoretical demonstration of piling spheres of equal dimensions. This demonstration was used many years ago in connection with interstices in sandstone, with the same result, 26 per cent voids for spheres of the same size. It is believed that G. F. Becker was the author in mind.

In the second edition of 1911, of "Concrete Plain and Reinforced," by Taylor and Thompson, on pages 168 and 169, a similar demonstration is given in the following language: "The fact that the percentage of voids in a mass of equal spheres symmetrically piled in the theoretically most compact manner is independent of the actual diameter is simply a geometrical proposition, evident without demonstration by inspection of Fig. 58." The result is 26 per cent voids. However, extending the quotation may give a practical view of the question: "In actual experiment it has been found that while the percentage of voids is uniform regardless of the size of the spheres, it is impossible to pour spheres into a measure so that they will arrange themselves symmetrically, and the rather astonishing result has been reached by Mr. Fuller (see p. 185) that 44 per cent is the smallest percentage of voids which can be obtained with equal perfect spheres, no matter what may be their actual diameter or the size of the receptacle." Mr. Fuller on page 185 says, "This is assuming that every particle is placed exactly in its assigned place, but it is inconceivable that such an arrangement should take place under practical conditions, and in fact numerous trials by the writer with large masses of equal-sized marbles have demonstrated that they cannot be poured or tamped into a vessel so as to give less than 44 per cent voids."

May the foregoing not suggest that further practical experiments should be made before attempting to correct texts, notes and catalogs.

R. D. PERKINS.

Los Angeles, Calif.

Recent Technical Publications

Reviews, Abstracts, and References

Platinum Promotions in Idaho

Idaho Platinum—A week or so ago we called attention to the exposé of platinum fakes by the U. S. Bureau of Mines. Another report has been issued by the Bureau of Mines and Geology of Idaho, as Pamphlet No. 6 (13 pages; obtainable on request to the Bureau at Moscow, Idaho). This bulletin gives the results of an investigation designed to confirm if possible the reported occurrence of platinum at the Home Builder, the Caribou, and the Wilson Mutual or "Green" properties in the Kootenai country of Idaho. Flattering reports of platinum were based on assays made by R. A. Dozier, of Grants Pass, Ore. No platinum was found, however, by the investigators. It is Mr. Dozier's claim that the explanation of this discrepancy lies in the fact that his methods are superior to those employed by anyone else and that none is competent to determine platinum or the platinum-group metals except himself, his associates, and his pupils. Mr. Dozier also claims to be producing platinum in commercial amounts although the statistics of platinum production in Oregon fail to record any increase due to his operations. The report indicates that the backers of the properties above mentioned were honest in their promotions, and were merely the victims of certain unscrupulous assayers.

Mining Zinc Ore—The September *Bulletin* of the Canadian Institute of Mining and Metallurgy (603 Drummond Building., Montreal; price 50c.) contains a 26-page paper on "Mining Practice at the Sterling Hill Mine of the New Jersey Zinc Co." This is the only place in the world where the mineral franklinite occurs in economic quantities. Practically all of the ore is mined by shrinkage stoping, both transverse and longitudinal stopes being used. No pillars have yet been mined at Sterling Hill but a caving method, modeled after the top-slicing system, has been tried out for pillar robbing and has proved satisfactory. The description of the mining methods is illustrated by many sketches.

Cinnabar Industry—"Some Essentials in the Economic Development of a Cinnabar Deposit" are given in a 6-page article in *Chemical Engineering and Mining Review* for July (Melbourne, Australia; price 11d.) The article discusses the economic side of the quicksilver industry and points out important considerations that should be studied before opening a cinnabar mine. Four main factors are given: (1) The market is ever in danger of over-supply from the huge orebodies in Europe. (2) The starting point in the valuation of mercury is set by the cost of production at Almaden, in Spain, and this is only about $18 per flask. (3) The basic level of mercury prices is that price which will sufficiently remunerate the Rothschilds for the distribution of the Spanish product; this is between $30 and $35 per flask. (4) The demand for mercury is not likely to increase much in the near future.

Electrolytic Iron—"Making Iron from Ore by a New Electrolytic Process" is the title of an article of four pages in the Aug. 30 issue of *The Iron Trade Review* (Cleveland, Ohio; price 25c.) The Eustis process used at the plant of the Milford Electrolytic Iron Co., Milford, Conn., is described. At present about half a ton of ore a day is dissolved.

Oxidizers in Cyaniding—"The Use of Oxidizers in the Cyanide Treatment of Concentrates" is the subject of a six-page discussion in the June issue of the *Journal* of The Chemical, Metallurgical and Mining Society of South *Africa* (Price 3s. 6d., Johannesburg). Permanganate of potash, lead peroxide, and barium peroxide were used experimentally. All three gave improved extractions generally; permanganate sometimes increased the cyanide consumption, lead peroxide invariably increased cyanide consumption, but barium peroxide usually decreased cyanide consumption. All three at times gave disappointing results. Barium peroxide was adopted for use on a commercial scale, from one-half of 1 per cent to 1 per cent of the dry weight of the black sand concentrate being used. The roasting plant formerly used at the Witwatersrand Cooperative Smelting Works has been dismantled since the use of this reagent has been made.

Production of Explosives—Technical Paper 340, 25 pages, obtainable on request from the U. S. Bureau of Mines, Washington, D. C., is devoted to statistical matter relating to the production and distribution of explosives in the United States during 1922.

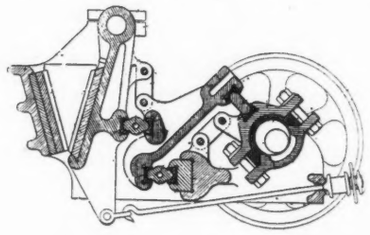
Cyanide Precipitants

Some years ago the *Engineering and Mining Journal* published a small 50-page book entitled "Cyanide Precipitants," which was made up of four articles that had appeared in the *Journal*. These were "Tests of Zinc Dust for Cyaniding," by W. J. Sharwood; "Notes on the Analysis of Zinc Dust," by J. E. Clennell; "Aluminum Precipitation at Nipissing," by E. M. Hamilton; and "Rapid Silver Estimation in Mill Solutions," by G. H. Clevenger. A few copies of this book are still available, and to clean them out will be mailed to any of our readers at 25c. each. Address Circulation Department, McGraw-Hill Co., 10th Ave. at 36th St., New York.

Colorado Plateau—"Rock Formations in the Colorado Plateau of Southeastern Utah and Northern Arizona" are described in *Professional Paper* 132-A, 23 pages, obtainable on request from the U. S. Geological Survey, Washington, D. C. Brief descriptions of the rocks of the region are given as well as detailed geologic sections and columnar sections.

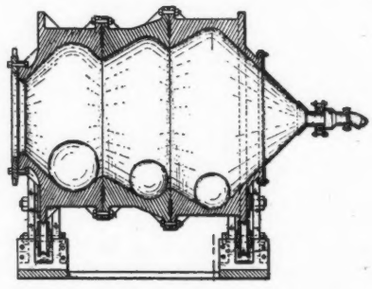
Patents

Rock Crusher—No. 1,459,130. June 19, 1923. W. R. Young, Brooklyn, N. Y., assignor of one-half to S. K. Greene,



Brooklyn. A swing-jaw crusher of the type indicated in the accompanying illustration.

Pulverizer—No. 1,458,486. June 12, 1923. C. A. Kloman, Bellevue, Pa. The design of this pulverizing mill is made



plain by reference to the accompanying illustration.

Vibrating Screens—Nos. 1,459,837 to 1,459,847. June 26, 1923. Benjamin A. Mitchell, of Garfield, Utah, and St. George, N. Y., in part assigned to Minnie L. Mitchell, Magna, Utah. This series of patents covers the various parts of the Mitchell electrically vibrated screen which has been marketed and successfully used during the last two or three years.

Percussion Drill—No. 1,459,848. June 26, 1923. Benjamin A. Mitchell, Garfield, Utah. This is a drill which is actuated by a rotor similar to that used in the screen covered in the preceding patents.

Rock Pulverizer—No. 1,460,008. June 26, 1923. C. S. Willis, Bellingham, Wash. A rod pulverizer with supports at each end to prevent the rods from moving collectively around the frame, and means for screening the ground material as it falls from the rods.

Mineral Washing Device—No. 1,460,196. June 26, 1923. Antoine France, Liege, Belgium. A wet-sorting apparatus suspended from a launder, provided with movable screens.

SOCIETIES, ADDRESSES, AND REPORTS

Silver Men Hold Conference at Reno

Principal Feature of the Meeting Is Resolution to Form an Export Association

By George J. Young
Associate Editor

The stage has been set for the formation of a silver export association. Both small and large producers have signified a willingness to join such an organization which will probably be formed at a future meeting of the producers. There seem to be no legal obstacles and a committee has been appointed to look into details and provide a permanent organization for the convention. Statesmen and mine executives contributed freely of their views on how the position of silver could be bettered.

GOLDEN sunshine, as usual, in Reno, greeted those who assembled at the University of Nevada on Sept. 4 for the Nevada Conference of Silver Producers. Important matters were due for discussion and the time was limited so a prompt start was made. Senator Oddie, chairman of the Senate Committee on Gold and Silver Inquiry, called the meeting to order.

Senator Oddie briefly reviewed the work of the Senate Committee on Gold and Silver Inquiry and commended the work of Senator Pittman and his colleagues and also the work of Henry Rives of the Nevada Mine Operators' Association in the control of the situation which arose through the administration of the Pittman Act. He called attention to two recent Government compilations of silver statistics which were distributed at the meeting.

Senator Oddie stated that Senate Committee had retained Fletcher Hamilton to visit silver producing districts and determine the facts of gold and silver production so far as they related to costs of production and returns upon mining investment.

In closing his remarks and before introducing Senator Pittman, Senator Oddie stated that silver producers could organize to their great advantage and that organization was essential in the orderly marketing of the products of mines.

Senator Pittman is a forceful speaker. He plunged into the subject of the administration of the Pittman Act and after a brief review of the history of events culminating in the passage of the Pittman Act, and which need not be recounted here, he said: "I intend to introduce a resolution asking for the formation of a silver export association. I intend to ask for the oppointment of a committee to work out the details of such an association and to consummate that organization.

"Every coin at a dollar an ounce was paid for out of the British Treasury," Senator Pittman said. "It cost the United States nothing. The silver producers received no bonus." After a brief discussion of the administration of the details of the Pittman Act, undersecretary Gilbert was severly criticized. "Gilbert," he said (referring to the use of standard silver dollars for subsidiary coinage) "didn't deny that they had been coined but sneeringly said 'you cannot earmark silver bullion.' He said he was saving the people $5,000,000—he said the Government had given the mining men a bonus of $62,000,000. The Government gave the producers nothing. What profit they made came from the British Treasury."

Continuing, Senator Pittman said: "The Comptroller General has had our evidence under consideration now for about five weeks. He didn't pass it up by any means. There is evidently something in the record that has attracted his attention." The senator suggested that the silver producers, in case that the undersecretary's action is not reversed by his superior, have the alternative of a writ of mandamus in the district court of the District of Columbia, citing the Treasury Department to show cause why it should not perform its duties under the provisions of the Pittman Act.

Senator Gooding briefly addressed the meeting and pointed out the pressing need of organization. Without the Pittman Act, he said, the silver producers would have been in the same position as the farmers. The country did not want any man to produce at a loss. Organization would bring about an orderly marketing of products. The Senator said: "Many other industries have organized, and the silver miners, if they do not want to be in the same condition as the wheat growers, must also organize."

At the afternoon session Senator Oddie stated in reopening the meeting that 75 per cent of the silver producers of the United States were represented at the meeting as well as representatives of silver producers from Mexico. He suggested that steps be taken to effect a temporary organization. W. Mont Ferry, vice-president of the Silver King Coalition Mines Co., was placed in nomination for temporary chairman and was elected. Henry Rives was elected temporary secretary.

Conference Organizes

With W. Mont Ferry in the chair, the meeting convened on Wednesday morning and received the reports of the organization and credentials committees. The committee on organization recommended that the temporary officers be retained as permanent officers and that a permanent organization of silver producers must be effected. Two resolutions, one relating to an appeal to the railroads to restore the existing lead-bullion rates to the prewar basis and the other thanking and conveying the appreciation of the meeting for the efforts of the Senate Committee in bringing the silver producers together and the work of the committee in following the administration of the Pittman Act, were read and quickly adopted. A resolution introduced by Senator Pittman was read as follows:

Resolved, that it is the sense of this convention of silver producers, assembled at Reno, Nev., this 4th day of September, 1923, that:

1. A silver export association be organized under the Webb-Pomerene Act and under such amendments to such act as may be had.

2. That a committee of not less than fifteen members representative of the silver mining industry of the United States and such other countries as desire to participate, be appointed by the Chair within two weeks from date, which committee shall be authorized and directed to proceed immediately to the consideration, formulation and organization, and if a satisfactory plan can be agreed upon that such an export association be organized by such committee.

3. That the committee shall have power to appoint a subcommittee or subcommittees to conduct such work and to act subject to the approval of the committee.

4. That the committee shall from time to time, as may be advisable, report their action to the members who now constitute, or who may hereafter constitute, the membership of this body, or any body arising therefrom.

Senator Pittman in support of his

resolution addressed the meeting on the subject of export associations. He said that the Sherman Law and the Clayton Act were laws directed against monopolies in restraint of trade. In many foreign countries there were laws that encourage monopolies. Experience had taught us that in competing in foreign trade with these monopolies our exporters were at a great disadvantage. To overcome this difficulty Congress passed the Webb-Pomerene Act to promote export trade. This act, permitted the formation of monopolies for the purpose of export. There had been fifty-five export associations formed under this law. They were all operating more or less successfully. None of these associations could market in the United States.

This convention, he said, was a voluntary organization. The resolution provided for the organization of a corporation under the laws of the United States and that corporation must be organized under the Webb-Pomerene Act. It would be necessary, he said, to get the cooperation of the reducers of silver such as the smelting companies. It was also essential that we should have the cooperation of the major elements that had to do with the marketing of silver.

The essence of the situation was prompt action, said Senator Pittman. The fear that the fifteen or more men on the proposed committee would make a mistake was far less than the fear that nothing would be done and it was for this reason that the committee had been given power to act promptly without having their findings approved by this organization.

F. H. Brownell's contention that a silver export association might not fully comply with the conditions of the Webb-Pomerene Act, due to ambiguous construction that could be placed upon certain provisions of the act, was not, in Senator Pittman's opinion, well founded or, if it was, then the Act was not a workable one. What was wanted was an association that would extend credit to the small producer to help him from sacrificing his product. Such an association would gather information.

The method now in vogue of marketing silver was explained in detail by Senator Pittman. The important object was to bring silver back to its natural level comparable to other products. It could be done if the conference adopted the resolution, he asserted.

Senator Pittman's address was a noteworthy one and the speaker's sincerity in his stand for an export association affected the whole conference and aroused an enthusiasm that had been lacking before. He was followed by Cornelius F. Kelley, president of the Anaconda Copper Mining Co. Mr. Kelley endorsed everything that Senator Pittman had said. He said that he was in accord with the spirit and desirability of doing what could be done for the white metal. He stated that the position of the Anaconda company is no different from that of the smallest silver miner in the room. "We are silver producers and we have identical interests with the small producers of silver," he said. Continuing: "It would be a simple matter to organize an association and to form a nominal silver selling agency but when it comes to operation there will be many large problems to solve. Under the provisions of the Webb-Pomerene Act, it is a crime, directly or indirectly, to influence a domestic price. As a director and officer of the Copper Export Association, I have had experience in this phase of activity and I feel it to be my duty to give you the benefit of my experience."

Mr. Kelley recounted the experience of the Copper Export Association when it had borrowed a large sum on the metal held by the association at a time when two billion pounds of copper hung over the world market and the copper industry was threatened with disaster. This sum was secured to meet the pay-

C. F. Kelley, president of the Anaconda Copper Mining Co. injected some sound advice on the limitations of an export association that are well worth considering and pondering over. He called attention to the difficulty in controlling the world silver market owing to the small part of the world production that would be pooled in the association. Mr. Kelley's remarks are given in full on this page together with the views of other executives who took a prominent part in the deliberations.

rolls of the companies and at the same time to avoid selling copper at a ruinously low price. Legal action was only staved off when it was shown that the price of copper had dropped from 14c. to 11.5c. per pound and it was the only recourse copper producers had.

"It would be a mistake," said Mr. Kelley, "to preach to silver men that all they have to do is to organize. The United States produces normally from 50,000,000 to 60,000,000 oz. of silver per year. The world production ranges from 160,000,000 to 200,000,000 oz. per annum. It would be folly to talk of an export association that controlled only a small part of the world's production exerting any influence on the price. It is easy to advocate the control of the silver market but even with a pooling of all of the world's silver there would be a tremendous problem to cope with."

"The officers of the association would have to be in a position to finance loans on silver deposited with the association. There would be a large financial responsibility. Nevertheless, in spite of all the problems involved, there is much that a silver association can do. By gathering market information silver producers could keep in touch with the situation as it develops. Such an organization could rectify present inequities in shipment charges. Don't forget," continued Mr. Kelley, "that London is the buying market and through its control of financial and diplomatic channels will probably continue to be the silver buying market, notwithstanding the organization of a silver export association. I think it a mistake to allow the idea to be disseminated that we are going to wrest control of silver from London. Our purpose should not be to antagonize, but merely to cooperate for the best interests of all. As I see it, we must overcome the legal difficulties presenting themselves in this problem. We must control more than the production of the United States. We must create the financial machinery to carry on the work of the association. Furthermore, it must be understood that under the operation of such an organization the silver producer would have to put his metal in the hands of the men responsible for its marketing and allow them to have complete control of its disposal."

Mr. Kelley's words of caution and sound sense were of the greatest value in bringing to the conference an adequate idea of some of the vital factors involved in the proposed organization. He disabused the minds of the conference of the idea that such an organization as proposed could restore the price of silver to $1 per ounce and showed that this could only result from the necessary economic conditions which could not be controlled by any one.

Mr. Kelley said further that the silver situation would, in his opinion, improve as the dumping of silver upon the world's market had about ceased. He stated that the Anaconda company would join a properly organized association. In conclusion, he said, "I do think that much can be done by a silver export association."

At the beginning of the afternoon session Senator Walsh of Montana was introduced. Senator Walsh endorsed the general principle of the export association.

William Loeb, vice-president of the American Smelting and Refining Co., commended the idea of the silver export association and referred to F. H. Brownell's letter already published as the best thought upon the subject from his company. Even without a silver export association he said that much could be done by an organization of silver producers in keeping themselves informed about all phases of the silver situation and exerting their influence to encourage the industrial and monetary uses of silver. D. D. Muir, of the United States Smelting Co., and Frank M. Smith, of the Bunker Hill & Sullivan Smelter, made short addresses and signified their support of the export association idea.

Export Association Resolution Unanimously Adopted

Senator Pittman's resolution advocating the prompt organization of a silver export association was then put to a vote and unanimously adopted by the convention. The convention adjourned after instructing the chairman to call a future meeting at such time as the committee instructed to effect the organization of the Silver Export Association reports.

MEN YOU SHOULD KNOW ABOUT

C. K. **Leith** recently made a short trip to the Minnesota and Michigan ranges.

J. F. **Callbreath** was recently in San Francisco and attended the State Fair at Sacramento.

F. W. **Traphagen** is in New York on business connected with mining companies of Arizona.

Roy A. **Hardy**, of Comstock, Nev., has resigned as manager of the United Comstock Mines Co.

W. O. **Hotchkiss**, State Geologist of Wisconsin, is directing a magnetic and geologic survey of the pre-Cambrian

W. O. Hotchkiss

area of that state, which is in the immediate charge of **H. R. Aldrich**. Investigation of available road materials is being conducted by **E. F. Bean**, Assistant State Geologist.

Walter A. Reid, metallurgist for the United Comstock Mines Co., has resigned from the company.

W. Lee Heidenreich has returned to New York from a visit to the property of the Nipissing Mines Co., at Cobalt, Ontario.

Eugene Dawson has returned to New York from a several month's examination of mining properties in Colombia, South America.

Henry Krumb has cabled from Japan that he has arrived safely at Nagoya after a terrible experience in the recent catastrophe.

James W. Robertson, of Ottawa, has been appointed a director of the Beaver mine of Cobalt, of which he is one of the largest shareholders.

J. Gordon Hardy, of the Mining and Development Corporation, New York, is returning to Italy on business connected with zinc mines there.

H. S. Pickands, of Cleveland, Ohio, a member of the firm of Pickands-Mather Co., made a recent tour of inspection to the company's properties on the Mesabi iron range.

F. A. Jordan, who recently resigned as general superintendent for the Mesabi Iron Co., Babbitt, Minn., has left for Port Henry, N. Y., to assume a position with Witherbee, Sherman & Co.

Ralph L. Motz, who has been with Smith & Ziesemer for the last sixteen years, has bought the engineering and assaying office of that firm. Associated with him will be **Linden T. McElvenny**, of Butte.

F. R. Pyne, formerly works superintendent of the United States Metals Refinery at Chrome, N. J., has been appointed assistant superintendent of the Laurel Hill, N. Y., refinery of the Nichols Copper Co.

Waldemar F. Dietrich, associate professor or mining at Stanford University, is organizing an efficiency department for the Cia. de Santa Gertrudis, at Pachuca, Mexico, while on sabbatical leave of absence from Stanford.

Alfred R. Whitman, who for the past two months has been making a study of the Rouyn gold area, in addition to examining the Castle-Trethewey mine at Gowganda, Ontario, has resumed his duties on the staff of the University of California.

D. G. Kerr, of Pittsburgh, Pa., vice president of the U. S. Steel Corporation, is spending a month's vacation in the woods near Watersmeet, Mich. **William E. Corey**, of New York, president of the Midvale Steel & Ordnance Co., recently returned from the same camp.

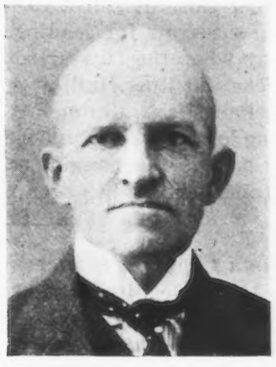
Mining and Metallurgical engineers visiting New York City last week included: **C. M. Eye**, of San Francisco; **Orrin P. Peterson**, of Hinsdale, Ill.; **W. Myron Davy**, of Pachuca, Mexico; **K. Nishimura**, of Tokyo, Japan; **W. L. Remick**, of Pittsburgh, Pa.; and **J. L. Kalb**, of Rapid City, S. D.

C. E. Steidel, attached to the Washington office of the Bureau of Mines, left for San Francisco on Sept. 8 to take over the compilation of the statistical reports as to the production of gasoline, kerosene, lubricating oils, and gas and fuel oils in California, which are published monthly by the bureau. **E. C. Lane**, assistant chemist, who has heretofore compiled the California statistics, will remain with the Bureau of Mines at San Francisco, but will devote his entire attention to research in problems in the chemistry of petroleum.

At the business meeting of the Lake Superior Mining Institute held in Hibbing, the following officers were elected for the coming year; president, **James E. Joplin**, of Ishpeming, Mich.; vice presidents, **William H. Schacht**, of Painesdale, Mich., and **W. E. McRandall**, of Bessemer, Mich.; managers, **Frank Carliss**, of Iron Mountain, Mich., **James Wall**, of Iron River, Mich., and **J. W. Van Evera**, of Crosby, Minn.; treasurer, **E. W. Hopkins**, of Ironwood, Mich.; secretary, **O. J. Youngbluth**, of Ishpeming, Mich. The next meeting of the Institute will be held in Michigan on the Marquette Range. The date of the meeting will be announced later.

OBITUARY

Chester W. Purington and his two children, with their governess, lost their lives in the earthquake in Japan. Earlier reports to this effect have been verified by a cable from Mrs. Purington who succeeded in reaching Kobe in safety. Mr. Purington was in Tokio at the time of his death. Since 1918 Mr. Purington had been engaged in the exploration of the northwest Pacific littoral region of Asia, mainly in the Kamchatka-Okotsk districts of Siberia. He had an abiding belief in the mineral resources of eastern Siberia which he held to the last. He was on the direc-



Chester W. Purington

torate of two British companies, the Ayan Corporation, Ltd., and the Far Eastern Development Co., Ltd., and also of the Aian Gomei Kaisha, a Japanese company. In 1917 in association with other engineers familiar with Russian conditions, he gave the government at Washington evidence of the need of sending an expeditionary force to Siberia to save the Russian commonwealth. The reports failed to convince the President, however.

Mr. Purington was born in Boston in 1871 and graduated from Harvard in 1893. He served on the economic staff of the U. S. Geological Survey from 1894 to 1897. In 1897 he made his first trip to eastern Russia following which he engaged in examination work in South American and the East.

From 1902 to 1907 Mr. Purington was consulting engineer in Denver, in partnership with Godfrey Doveton. During this time the firm made examinations in Mexico, the principal one of these being the Cananea Consolidated, where, as assistant to John Farish, Mr. Purington made a complete geological examination of the property. In 1904 he was engaged on special report work by the U. S. Geological Survey on the costs and methods of alluvial mining in Alaska. Since 1907 he has done most of his work in Siberia.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL-PRESS is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Leading Events

METAL PRODUCTION is increasing in most of the districts of Colorado. Estimates indicate that the output for 1923 will exceed by 50 per cent that of the preceding year.

C. F. Kelley declares that 70 per cent of the proceeds of copper sales at Butte go to the miners as wages.

A new record for loading iron ore was established recently when the Oliver Iron Mining Co. mined 85,000 tons from its Rust-Hull pit in one day.

The Park-Utah Mining Co. offers its employees free building lots at its new townsite near Park City.

The last of the hanging-wall shafts on the Gogebic Range in Michigan has been worked out and abandoned.

The Comptroller of Currency has declined to reconsider his ruling regarding the revoking of allocations of silver under the Pittman Act.

London financial houses appear to be stimulating the stock market preparatory to unloading mining shares.

Arizona copper producers continue to operate despite the market. Some will probably suspend production unless improvement is forthcoming.

United Comstock reports operating loss of $239,392 for current year to date.

The Copper Range Co. has obtained the last outstanding 100 shares of Trimountain stock and will dissolve the company.

Arizona Copper Producers Continue Despite Market

Situation Grave—Labor Scarce—Shut-Down Expense Important Item Because of Disorganization

While the situation in the copper industry is realized by Arizona operators to be serious, due to the abnormally low price for metal, there has been no curtailment or shutting down of importance up to the present time in the Arizona districts. The larger companies are continuing at a rate of production that is near normal and there has been no announcement of contemplated curtailment. The high cost producers are facing a grave situation, if the present market tendency continues, and it is likely that some operations will not be continued under the circumstances. Decreased freight rates and taxes have lightened the stringency this year and other economies in operation have added to the reductions in cost that enable the operators to meet conditions. The labor situation in Arizona mines is not improved and there is need for many more miners. Men who are at the head of two of the largest mines in Arizona have stated that their companies do not contemplate any reduction in output at the present time and have added that they do not consider it likely in the near future. It was necessary for most operators to rebuild an entire organization during the past year following the long period of cessation, and the difficulties and expense are well remembered. This, it is considered, will militate against shutting the mines down again unless a definite period of low price for the metal can be forseen.

Bonanza Ore Opened in Tom Reed Mine

A RECENT strike of high-grade ore has been reported in the Tom Reed mine at Oatman, Ariz. On the 300 level, some distance west of the main shaft, ore has been opened for a length of 80 ft., over four feet wide. Of this width 10 in. carries values of $3,000 to $4,000 and approximately four feet of ore has been cut that assays $120. This strike, it is claimed, surpasses any that has been made previously in the Tom Reed mine.

California Rand Mill Makes Best Record of Its Career

93.54 Per Cent of the Silver Recovered in Flotation Concentrate

During August the California Rand Silver, Inc., operating at Randsburg, Cal., milled 9,711 tons of ore of an average value of $20.62, of which $18 was silver. The extraction of silver was 93.54 per cent and of gold 73.7 per cent making a total recovery in concentrate of $182,819. According to M. N. Coleman, superintendent of the mill, this report shows the highest average extraction in the history of the company's operations. It would have been still higher had not 1,260 tons of oxidized ore from the dump been included in the mill run. Shipments to the smelter included 602 tons of concentrate averaging $326.46 per ton and 43 tons of high-grade ore. Dividend No. 44 for 2c. a share was distributed Sept. 4.

United Comstock Ore Reserves 2,000,000 Tons at $3.10

Statement to Tax Officials Bases Estimate on 62c. Silver—Operating Loss $239,392

In a petition asking for a reduction in taxes the United Comstock Mines Co. of Virginia City, Nev. states that the company to date has sustained operating losses of $239,392, and that the enterprise should still be classed as an experiment.

The company is the largest silver-gold operator in Nevada and last year completed construction of a 2,500-ton mill, one of the largest plants of its kind in the world. Five hundred men are employed and the mill is treating approximately 2,000 tons of ore daily. The monthly payroll approximates $90,000.

The official statement to the board of equalization sets forth that the mine contains 2,000,000 tons of ore valued at $3.10 per ton with silver around 62c. an ounce. The ore runs 30 to 35 ounces silver to one of gold.

The company has protested the tax valuation of $1,200,000 placed upon it by the assessor of Storey County, and asked that the valuation be cut to $455,850. Bulkeley Wells, managing director, and a large number of operation officials resigned recently following a change in administration. R. H. Channing who has been identified with a number of large mining enterprises in the West has been made managing director. The company is financed by Harry Payne Whitney and associates of New York through the medium of the Metals Exploration Co.

Calumet & Hecla Consolidated Copper Co. Ready for Debut

Share Holders in Merged Companies Approve Plans—88 Per Cent Affirmative Vote—Can Profit on 14c. Copper, Say Officials

One more large copper producing unit is an accomplished fact; shareholders of the Calumet & Hecla, Allouez, Ahmeek, Centennial, and Osceola mining companies in Michigan have approved the terms of consolidation into the Calumet & Hecla Consolidated Copper Co. The greatest significance of the overwhelming majority of 88 per cent voted in favor of the merger is the realization of the shareholders that in these days of keen competition and mounting operating costs, only the larger, self-contained units with centralized control can hope to make a reasonable profit on low grade ores.

Calumet & Hecla mill. Steam stamps crush copper ore in Michigan

The president of the new company will be R. L. Agassiz and associated with him as directors will be Thomas L. Chadbourne, of New York; John T. Burnett, Earnest B. Dane, Dudley S. Dean, Harry F. Fay, Robert F. Herrick, Francis L. Higginson, Thomas Perkins, William A. Hodgson and James A. Mac Naughton.

The new corporation will have an uninterrupted stretch of over seven miles on the three major lodes of the Lake Superior copper country—Calumet & Hecla conglomerate, Osceola amygdaloid and Kearsarge amygdaloid lodes. Through the five old companies the new unit will have hundreds of miles of underground workings.

Calumet & Hecla Consolidated will have a sound financial base. As of June 30 last combined net current assets of all five companies amounted to $18,577,053, of which $8,221,071 represented cash and government securities. This makes over $9 per share in "net quick."

From this is to be deducted approximately $2,000,000 representing cash payments to be made to shareholders who have participated in the consolidation. Deducting these cash payments, however, there is still "net quick" of over $8 per share on the new stock.

Fixed assets, representing the value of properties, exclusive of surface plant, equipment, machinery, etc., are valued at nearly $71,000,000. This is over $35 per share on the new stock and is the property value arrived at by averaging the findings of the mining engineers and geologists who spent months making an exhaustive survey of the properties. Reduction works, smelters, refinery and timber lands add millions of dollars of additional value.

It is too early yet to estimate what prospective production will be. It is not known just what the new economies will bring forth. The management estimates, however, it will be able to pay dividends of at least $2 per share on the new stock on a 14c. copper market. This of course includes the operation of so-called reclamation plants that recover copper from old tailing at around 6c. per pound.

Oliver Company Breaks Record for Iron Ore Mining

85,000 Tons Loaded From One Pit in a Single Day — Seventeen Shovels at Work

On Aug. 29 a total of 1,719 fifty-ton cars were loaded and shipped at the Hull-Rust open pit of the Oliver Iron Mining Co., Hibbing, Minn. This was approximately 85,000 tons and is a record for iron ore properties. The cars were loaded during two 10-hour shifts and there was a delay of two hours because of a shortage of cars. On that day there were seventeen steam shovels at work in the pit, including two new ones of the 350-ton type, one a Bucyrus; the other a Marion.

Heavy shipments are being made from the mines of the Mesabi range at this time, the Duluth, Missabe & Northern road handling 3,498,000 tons during August, while the other lines that serve mines of that district also carried large tonnages. The total shipments from the Lake Superior region in August were 10,296,038 tons.

Free Home-sites and "Plans" for Park-Utah Employees

Company Encourages Building on New Townsite—Excellent Location for Permanent Home

The Park-Utah Mining Co. of Park City, Utah, the newest large producer of the camp, in the eastern and hitherto largely undeveloped section, is now so solidly established that it has chosen a townsite near the Fisher ranch where homes will be erected for employees so that the company may have a permanent and dependable working force. The town will be called "Keatley" after Superintendent Keatley who directed the driving of the Ontario drain tunnel. Employees are to be encouraged to build their own homes. The company is offering building lots free to those who build this fall, and is furnishing plans for five-room cottages costing from $1,250 to $2,000. The town will be laid out with gardens and trees, and will have all modern conveniences. As it is situated in the neighborhood of a farming community, fresh vegetables and fruit will be obtainable. The altitude is 6,500 ft.

Copper Range Gets Foley's 100 Shares

Can Now Dissolve Company and Operate Mines As Single Unit—Ends Long Contest

Through a settlement with the owners of the 300 outstanding shares of the Trimountain Mining Co., the Copper Range company operating in the Michigan copper district has acquired full ownership of the stock of that organization, after years of intermittent negotiation and legal action. The settlement makes possible the final dissolution of the Trimountain Mining Co., which has been controlled by the Copper Range company through ownership of 99,700 shares of the 100,000 capitalization.

Two hundred shares of the 300 outstanding, which were not turned over when Copper Range started out to acquire complete ownership, were held by Willard Saulsbury of Wilmington, Dela., and 100 by Michael M. Foley of Houghton, Mich. Mr. Foley was the last to hold out and his stock has now been procured.

Court proceedings to bring about the dissolution of the Trimountain company resulted in a verdict for the Copper Range company in the circuit court of Houghton county, in 1917, but this finding was subsequently set aside by the Michigan supreme court, since which time Trimountain has continued as a separate company although its operations have been controlled by Copper Range. The present settlement means that separate bookkeeping, and reports, no longer will be necessary and Trimountain will be operated as a unit of the Copper Range company, like Baltic. This will result in more convenience and reduced expense to Copper Range.

Labor Gets 70 Per Cent of Selling Price of Butte Copper

C. F. Kelley, Anaconda Head, Corrects Impression of Senator Walsh in Labor Day Speech

C. F. Kelley, president of the Anaconda Copper Mining Co., declared at Butte last week that miners and other workers in the employ of his company receive more than 70 per cent of the total price received by Montana mining companies for their metal.

Mr. Kelley was correcting a statement made by Senator T. J. Walsh at a Labor Day speech in Butte to the effect that but 24 per cent of the factory selling price of manufactured goods goes to the labor that produces them and that he believed that "labor gets no larger share in the mining industry than it receives from manufactured products generally." Mr. Kelley commented as follows:

"There never has been a normal time when Montana labor, employed directly in the mines, mills and smelters, did not receive between 50 and 60 per cent of the market price of copper, as it is sold in the markets of the world and this is the total price so far as copper producers are concerned.

"Since 1913—taken as the last prewar year—wages have increased in the copper industry in Montana approximately 50 per cent, supplies 66 per cent, freight 65 per cent, these being the principal items of cost. On the other hand the price has declined from an average, over a ten-year period prior to 1917, from 16⅝c. a pound to the present prevailing price of less than 14c.

"In other words, labor in Montana is receiving more than 70 per cent of the total price received by Montana producers for the metal against an average, according to Senator Walsh, of 24 per cent received by the employees of manufacturers generally.

"I suggest that data are available for the senator's information and that it is not necessary to indulge in misleading inference."

Wheels Turning in Sullivan Concentrator at Kimberley, B. C.

Consolidated M. & S. Co. Will Make Lead and Zinc Concentrates in New $2,000,000 Plant—Selective Flotation Feature —Equipment Made at Company Shops

THE newly completed mill at the Sullivan mine of the Consolidated M. & S. Co. of Canada at Kimberley, B. C., was started on Aug. 22; and the president, managing director, and several of the company's Western directors were present to see the power turned on and the plant officially put into operation. The completion represents the fruition of more than seven years of patient research, during which half a dozen plants of commercial dimensions were built and scrapped, to say nothing of a score or two of laboratory plants. The Sullivan ore, is an intimate mixture of zinc blende, marmatite, galena, pyrrhotite, and pyrite. It carries, as a rule, about 25 to 35 per cent of combined zinc and lead, the proportions of the two metals varying in different parts of the mine.

The new plant is patterned after the pilot that has been in successful operation at Trail for two years. The process consists essentially of coarse crushing and the removal of part of the galena on tables; the fine crushing of the tailing from this operation and the subjecting of the pulp to selective flotation. The products are a coarse and a fine galena concentrate, each running about 80 per cent of lead, and a fine zinc concentrate containing about 60 per cent of zinc and a considerable proportion of lead.

When it is tuned up to capacity it is estimated that the mill will be capable of treating 2,500 tons of ore daily. With the exception of the large rock-breakers and the electric motors, the whole plant has been built in the company's shops at Trail and at Kimberley, under license, of course, from the several patentees.

The original appropriation for the plant was $1,500,000; the increasing of the capacity has necessitated an expenditure considerably in excess of the appropriation. As the company has been able to sell at a profit all the lead and zinc it can produce, the increase was considered to be justified.

The building that houses the plant is of steel and concrete and covers twelve acres; it is situated four miles from the mine, which was the nearest point where a sufficient volume of water could be assured and where adequate provision could be made for dumping the tailing. The whole plant is electrically driven, the current being supplied under a ten-year contract by the East Kootenay Power Co.

Last Hanging-Wall Shaft Abandoned on Gogebic Range

The last of the stockpile at "C" shaft of the Pabst mine, near Ironton, Mich., has been shipped, which marks the closing chapter of the last of the hanging-wall shafts of the Norrie-Aurora-Pabst group of mines. These shafts were large producers, but they went down through orebodies and were hard to keep up. Likewise they tied up large amounts of ore in pillars that had to be left to protect the shafts from shifting of the ground. Mining operations in this group of mines, which produce from 1,500,000 to 2,000,000 tons per year, are now confined to the seven shafts in the footwall, five of which are completely electrified. The abandoned hanging-wall shafts were all vertical, whereas all but one of those in the footwall are inclined at angles varying from 55 to 68 deg.

Pine Creek Section of Coeur d'Alene Busy

Idaho Camp May Have Railroad Spur—Would Serve Many Properties—New Equipment Installed

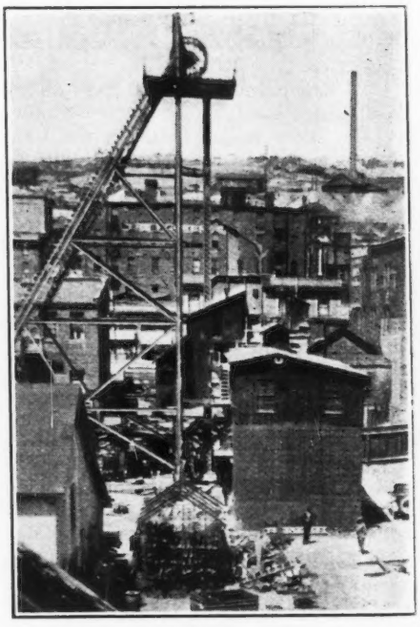
Development and installation of equipment is proceeding in several parts of the Pine Creek district, of the Coeur d'Alene region in Idaho. The frame for a mill of 50-ton daily capacity has been erected on the Amy-Matchless mine, under the direction of Gus Smith, manager. The plant is designed to dress zinc-lead-silver ore.

Alterations are being made in the mill of the Constitution Mining & Milling Co., owned mainly by residents of Spokane. A drift run in Burke quartzite for several hundred feet has disclosed an increase in the proportions of lead to zinc, as compared with the ore in the slates.

Determinations are being made of the zinc content in the zinc-lead-silver ore, of the Nabob Silver-Lead Co. The work is being done by Minerals Separation, with a view of installing an addition to the plant and increasing the grade of the concentrate.

At the Jim Blaine property, the crosscut tunnel has been extended 800 ft. and has recently encountered stringers of ore. This is one of the deepest tunnel developments under way in the Pine Creek district and will reach its objective at a depth of about 1,000 ft.

Engineers will begin a survey for a railroad spur in the Pine Creek valley. An extension is proposed from the end of the O.-W. R. & N. spur, which penetrates the valley for two miles. The extension would have a length of 7½ miles and terminate at Masonia, 1¾ mile from the Constitution mine. It would serve the Highland-Surprise, Nabob, Douglas, Sidney, Amy-Matchless, Jim Blaine and other properties.



Davis-Daly shaft in the heart of Butte, Mont. New sorting plant at right

Big New Shaft Will Have Steel-Concrete Lining

Contractors in Michigan to Use Mounted Drills in Preference to Jackhammer Type—New 5,000-Kw. Turbo-Generator

THE Castile Mining Co., a subsidiary of Oglebay, Norton & Co., has awarded a contract to The Foundation Co. of New York for sinking a new production shaft at Ramsay, on the Gogebic range in Michigan. The new shaft will be one of the largest on the range and will be situated between the present Eureka and Asteroid shafts. The collar will be some distance north of the footwall at surface, but at a depth of a few hundred feet there are some large faults which should throw the footwall north of the shaft. Thus the shaft will be in jasper near surface and in granite further down.

The surface material, which is glacial drift, will be penetrated by a circular drop shaft, and when solid rock is reached the regular rectangular shape will be adopted. The shaft will be "timbered" with steel and concrete. Work will be started at once. The contractors are to bring in their crews from outside of this district, because there is no surplus of miners, especially shaft miners, in this region and the mining company did not want any of its regular miners drawn from production work and put in the shaft.

For drilling it is planned to use mounted machines rather than the unmounted type which has been in general use for shaft sinking in the district. The use of a drop shaft is also new practice on this range. The shaft will probably be sunk to a depth of about 2,500 ft. at the present time, but it will be equipped to hoist from a maximum depth of 4,500 ft. Plans are already being made for an Ilgner type hoist. Aside from the operating economy of this type of hoist an important reason for its adoption locally is the fact that the public-service company furnishing electric power to the entire range refuses to connect any motor larger than 600 hp., and this is not large enough for the ore hoists used here. The Corrigan shaft of the McKinney Steel Co. at Bessemer was equipped a few years ago with an Ilgner set having a 500-hp. flywheel set and 1,650 hp. direct-connected hoist motor.

The Oliver Iron Mining Co. usually operates seven shafts on adjoining mines in Ironwood and four others within seven miles; accordingly it built its own power-generating station to avoid the limitations of buying power. This station was situated at the Pabst mine, and for the last four years has been operating with two 5,000-kw. steam turbo-generators. A third similar unit has just been received and will be erected in the next few months. This is to take care of the additional load which will have to be carried when the new Geneva shaft is put into operation. The main hoist there will have a 1,500 hp. induction motor.

News from Washington

By PAUL WOOTON
Special Correspondent

Comptroller Declines to Alter Pittman Act Silver Opinion

Avoids the Issue on Disputed Points—Cannot Require Secretary of Treasury to Act—Revocation of 10,000,000-Oz. Allocation Stands

Replying to a letter written by Senator Key Pittman, vice-chairman of the Senate Commission of Gold and Silver Inquiry, in which the Senator had requested reconsideration of a decision regarding authority for transfer of silver bullion from one account to another within the Treasury, Comptroller General J. R. McCarl has reaffirmed his view that allocations need not be treated as irrevocable sales.

According to this interpretation of the act of April 23, 1918, known as the Pittman Act, it was proper for the Treasury to transfer back to the standard silver dollar account bullion which had been credited or allocated at one time through the subsidiary account.

Comptroller General McCarl declines in his letter to express an opinion regarding whether the Treasury Department lawfully administered the Pittman Act, stating that he sees no good end to be served by attempting a determination as to the disputed facts, inasmuch as there is no duty in his office to require the Secretary of the Treasury to make purchases of silver under the act.

The letter of the Comptroller General in part follows:

"It appears from the papers transmitted that there exists a disagreement between the Senate Commission of which you are vice-chairman and the Treasury Department as to whether the latter lawfully administered the act of April 23, 1918, 40 Stat., 535, there appearing lack of agreement as to certain facts and conflicting opinions as to the intent of certain provisions of the legislation. I have examined all of the material submitted most carefully but see no good end to be served by attempting a determination of which is right and which wrong as to the disputed facts, there being no duty in this office to require the Secretary of the Treasury to effect purchases of silver under the act cited even if I should conclude from the facts and the law that such purchases should be made.

"This office acted upon the understanding that the so-called Pittman silver allocated had, in large part at least, actually been made into subsidiary coins, but also with the understanding that such allocations and the use of such allocated silver for subsidiary coins was not made necessary by a shortage of silver otherwise available for subsidiary coinage, but because of the more ready adaptability and availability to subsidiary coinage of the allocated silver than the Mint stock of silver, which, as a whole, was ample and otherwise available for subsidiary coinage. To state the matter in a different way, it was clearly made to appear to this office, and it is not made, be treated as irrevocable sales." understood now to be questioned, that the allocations of so-called Pittman silver, though such silver was largely used for subsidiary coins, were unnecessary except from the standpoint of convenience; the Mint stock of silver as a whole, otherwise available for subsidiary coinage, at all times being more than ample to meet the current needs for subsidiary coinage.

"Much of what is urged as mandatory as to purchases of silver upon allocation of silver dollars for subsidiary coinage, is in connection with the provision in the act of 1918 that such allocation shall be regarded as a sale or resale for the purposes of the act, it being also provided in the act that upon every sale of bullion the Secretary of the Treasury shall immediately direct the Director of the Mint to purchase silver equal to a certain number of grains pure silver in respect of every stamped silver dollar melted or broken up and sold as bullion. It is a reasonable interpretation of the provision that an allocation of dollars for subsidiary coinage should be regarded as a sale was to give an authority for purchase as to which authority there might otherwise be doubt, it being a transaction within the Department and not clearly within the sales provision of the act, and thus the authority be permissive rather than mandatory to make purchases on account of such transactions. At least taking it in connection with the showing that there was at all times and exclusive of the allocations, a sufficiency of silver in the subsidiary coin stock, the revoking of the allocations so as to permit restoration to the standard silver dollar stock the silver no longer needed in the subsidiary coin stock, to my mind does not necessarily suggest conflict with that provision in section 3 which is clearly mandatory as to a true sale such as a sale of bullion for commercial use.

"Upon the submission of the matter by the Secretary of the Treasury I was, and now am, unable to bring myself to believe this provision mandatory so as to require that all allocations, however and for whatever purposes

Officials Await Results of Anthracite Settlement

Coal Commission Preparing Final Reports for Submission Before Sept. 22—Helped Pinchot

Although high Government officials generously accord full credit to Governor Pinchot, of Pennsylvania, for successfully bringing together the anthracite operators and miners, there is no disposition to forecast the effect of the agreement by which operations in the hard coal fields are to be resumed.

With anthracite publicly characterized as a luxury fuel with a price already at the point where the purse of the consuming public is strained to continue use of this fuel, public officials are awaiting the effect of the settlement on the price of coal to the consumer with considerable interest. There is a feeling in Washington that if the price of anthracite at retail is advanced to any material extent, there will be a public reaction the course of which cannot be successfully anticipated.

One thing appears to be more or less assured, however; namely that the efforts which have been made by both Federal and State officials to prepare the people of the anthracite-consuming areas for a possible enforced use of substitutes have served to bring the essential value of these substitutes to the fore more prominently than perhaps has ever been done in the past. Whether the consumers or any considerable proportion of them will give a try-out to soft coal and coke immediately rather than run the risk of a future possibility of disruption of the anthracite supply remains, of course, to be seen.

Although the Coal Commission on the return of its members from the conference with anthracite operators and miners in New York City had stated that if negotiations again were interrupted, a statement fixing responsibility would be issued, the turn of events prevented any statement from being issued on this subject. It obviously would have disturbed the situation after Gov. Pinchot intervened at the request of President Coolidge. The Coal Commission, however, was a factor of considerable importance in the negotiations which the Pennsylvania executive conducted. For the first time in such mediation, there was available to the mediator a mass of statistics relating to the subject gathered by an impartial body. Governor Pinchot had full access to the information gathered by the Coal Commission regarding anthracite and several representatives of the Commission were placed at his disposal to interpret quickly this data.

The Coal Commission has been meeting daily both morning and afternoon working on its final report which is to be submitted on or before Sept. 22 when the life of the Commission ends. This will be of particular interest to the bituminous industry, but also will carry general conclusions and recommendations applicable to anthracite and bituminous alike.

News from Mining Districts

By Special Correspondents in the Field

London Letter

Financial Houses Would Unload Shares; Try to Stimulate Interest—Views of Silver Situation

London, Aug. 30—While it is an unfavorable factor for the country generally, the depreciation of sterling in terms of the dollar has raised renewed hopes in the breasts of holders of gold mining shares, as the companies are again receiving more in currency for their product. Unless, in many cases, dividends can be increased—or paid—there is little possibility of further necessary capital being raised. Economies are being effected in every direction, and attempts are being made to revivify the Kaffir market. One explanation of this is that the finance houses who take the shares that the public throw away in dull times, are desirous of unloading again in order to secure profits. Another, and perhaps more important, reason is that examination of the gold bearing reefs of the Transvaal and Rhodesia is continually in progress and gives favorable indications. Various places have been mentioned where high values occur. In order to work these reefs, however, considerable funds are required, and the public needs to be buoyed up with much better prospects now than in the past. A few have done well out of dealing in mining shares, but the bulk are losers, and while they would fain get the higher return such shares ought to yield, they complain that they have been let down too frequently. They are tired of having profits taken by promoters and market men from their pockets instead of from the mines. In no case does the State seem inclined to assist the industry with capital, arguing—and rightly—that such speculative use of public money is beyond their scope.

A certain amount of interest has been created on this side by the news cabled from New York of an attempt to control the market in silver. From inquiries I have made, little belief is placed in its success, if the scheme is ever started. In the first place, the capital mentioned, $250,000,000 though large, might not prove sufficient. In the second place, could all producers be induced to agree? In the third place, an attempt to secure a monopoly would fail. It has been suggested that the main ideas are to make China and India pay more for silver, in order that the American producer, having under the Pittman Act received $1 per ounce for the domestic metal, may continue to receive the same amount. The arguments used here in opposition are that though China and India are the largest consumers, silver is a commodity, and any attempt to maintain the price artificially for any length of time would fail. India has already a predilection for gold, and Eastern markets would be gravely disturbed if control of silver could be maintained for even a short period. Production would be stimulated in other parts of the world, and the case of the Secretan copper corner has been quoted. A further idea seems to be that as Germany can never get back to a gold basis, she must perforce use silver. Her position in this respect is little better, for in present conditions she cannot acquire either metal. And if she were able to purchase silver overseas, Gresham's Law would operate and the good currency would be driven out by bad. The above are some of the reasons why it is not believed that the American scheme would be successful.

Johannesburg Letter

July Figures Show Good Profit—Platinum Reported in Waterburg District

By John Watson

Johnnesburg, Aug. 7—The following results of operations for July of twelve leading mines have been published:

	Tons Crushed	Value or Revenue	Working Costs per Ton s.	Working Costs per Ton d.	Estimated Profit
Government areas	149,000	£279,156	17	7.5	£149,286
New Modder	118,000	241,044	16	1.0	146,154
Crown Mines	218,000	295,355	19	1.0	87,308
Modder B.	66,000	139,067	19	8.4	74,057
Modder Deep	44,200	106,477	17	9.0	67,220
City Deep	100,000	181,255	22	10.7	66,791
Van Ryn Deep	63,000	123,814	19	6.9	63,057
Brikpan	66,000	115,319	21	11.1	47,706
Springs	54,200	104,657	22	8.9	47,670
Geduld	67,500	105,690	19	3.0	40,799
Randfontein Central	196,000	225,512	19	0.6	40,191
Robinson Deep	71,600	.....	18	1.6	35,770

The annual report of the Transvaal Chamber of Mines, issued on July 30, shows that the average realized price during 1922 was 93s. per ounce for 7,683,719 oz. of South African gold. This gold was disposed of as follows:

Destination	Ounces
New York	4,491,931
India	2,846,015
East Africa	249,249
Egypt	8,375
Continent (Europe)	177,993
Trade (Jewellers, etc.)	73,997
Straits Settlements	84,606
West Africa	503

The new Royal Mint at Pretoria was visited by a party of about forty members of the Chemical, Metallurgical and Mining Society on July 31. The party, including several ladies, saw the process of minting silver coins, from the ingot to the finished coin.

The reported discovery of platinum on the farm Rietfontein No. 3, in the Waterberg district, 12 miles northwest of Naboom Spruib, has caused a stir of life in that district. A syndicate

has been formed in Johannesburg, registered under the company laws of the Orange Free State, to acquire the prospecting rights.

On Aug. 2, about 500 Transvaal Platinum shares changed hands on the Johannesburg Stock Exchange. The shares have a face value of 5s. each and reached 50s. per share. The discoverer of the platinum is said to be a prospector named Dolf Erasmus who has worked amongst the Waterburg Hills for many years. The reef is said to extend northward from Rietfontein No. 3 to Bokpoort in the direction of the Palala (plateau and river). It has also been traced to the northeast but is lost near the railway. The ores are said to carry tin, gold, arsenic and iron, besides platinum, of a potential industry.

An Electricity Commission, composed of Dr. H. J. van der Byl, Robert Miller and J. R. Fulton, with A. C. McColm and W. van Dalsen, has left on a visit to the Sabie district, to investigate the possibility of utilizing the water of the Blyde and other rivers in that district. The adoption of hydro-electric plants on several gold mines in that district has led to increased employment for both whites and natives.

BRITISH COLUMBIA

Combination Oreshoot Holds Out

The recent strike at the Combination mine, near Greenwood, is turning out even better than was at first expected. A sample across a 3 ft. vein gave an assay of 2.6 oz. in gold and 303 oz. in silver per ton, 13 per cent lead, 12 per cent zinc. The mine adjoins the Providence mine, from which many shipments of equally rich ore have been made.

Bonanza Ore in I. X. L.

The fortunate lessees of the I. X. L. mine, at Rossland, have run into another high-grade oreshoot, and have netted $24,000 for a single shipment of a few tons of high-grade ore to the Bunker Hill & Sullivan smelter, at Kellogg. A similar shoot, though less rich, was struck two years ago. The lessees will give no information as to the size of the shoot. The mine is owned by J. R. Baker, of Tacoma, who gave a renewal of the lease on the mine a short time ago.

Detroit Capitalists Abandon Florence Mine

The arrangement between the shareholders of Florence Silver Mines, Ltd., and a syndicate of Detroit capitalists, whereby the latter were to have purchased a controlling interest in the Florence mine and plant, at Ainsworth, has collapsed, and the mine reverts to the original holders. The company now proposes to float a bond issue to enable it to fulfill its agreement with the city of Nelson, whereby the latter is to supply electric energy to operate the mill. The agreement necessitated the construction of some 20 miles of high-tension line, half of which was to be built by the city and half by the company.

ONTARIO

Mining Corporation Has Taken 1,500,000 Oz. from New Mine

The Mining Corporation of Canada has issued an interim report on the company's Frontier properties at South Lorrain which now comprise approximately 500 acres. The total production during 1922 and up to July 31 of the present year has amounted to 1,500,000 oz., which has come entirely from high-grade ore. In addition there has been accumulated approximately 8,000 tons of mill ore containing about 250,000 oz., which requires further treatment. A further 120 tons of low-silver, high-cobalt ore has been produced and marketed for its cobalt contents. On several other veins a number of promising showings have not yet been developed, as exploration and development work has been hampered on account of the limited capacity of the shaft. A new shaft, however, is being sunk and will be in operation to the 550 ft. level in October, when work will proceed on a much more extensive scale. The report states that a large unexplored part of the property has the same favorable geology. The corporation have also started a number of men at work on its properties recently acquired in the Gillies Limit, about five miles from Cobalt.

Kirkland-Tough Oakes-Burnside Merger

The Kirkland Lake Proprietary is getting good results on the 800 ft. level of its property in Kirkland. It is reported that consolidation will shortly be effected with the Tough Oakes and Burnside, which are controlled by the Proprietary, and three other claims in the Kirkland district.

Two Options Dropped

John Taylor & Sons, of England, have relinquished their working option on the properties of the Kitchener-Kirkland in the Kirkland Lake area, diamond drilling having failed to disclose ore.

The Tonopah has dropped its working option on the Moffatt-Hall property, Kirkland Lake, and is concentrating its efforts in that area on the King Kirkland.

McIntyre Bullion Totalled $2,249,742 in 1922

The annual report of the McIntyre Mines in Porcupine for the year ending June 30 last, shows that there was treated 240,615 tons of ore, having an average grade of $9.96 and a gross value of $2,397,303. The total bullion recovered was $2,249,742, or an average of $9.35 a ton. This is an increase of $310,000 over the preceding year. Operating costs were $1,167,644, or $4.85 a ton, which is a slight increase over the preceding year.

St. Charles and Papassimakes Patch Up Differences

The differences between Dr. W. P. St. Charles and John K. Papassimakes in connection with purchases of the stock of the Hattie and Beatty mines which resulted in several lawsuits involving brokerage houses owing to the refusal of Dr. St. Charles to accept the stock, have been amicably settled. Dr. St. Charles has issued a statement withdrawing charges of fraud brought against Mr. Papassimakes and discontinued his action against him. A petition in bankruptcy filed by the brokerage firm of C. K. Dodds & Co. against Papassimakes has been withdrawn.

Colorado Metal Production Shows Good Increase

ALL ore-shipment records for San Miguel County, Colo., were broken during August with an output of 75 cars by the Smuggler Union, 79 cars by the Colorado-Superior, and 58 cars by the Tomboy, or a total of 212 cars for the month. These figures represent 100 more cars than were shipped during August, 1922, and 50 more than were shipped during July of this year.

Not only is San Miguel County making record production, but the same is true of San Juan and Saguache counties. Practically every metal mining county in the state, excepting strictly silver producers, is increasing its output over last year. Cripple Creek output for August was 32,958 tons, of a gross value of $406,288.68, exceeding in value that of July by $67,293.68. Colorado's output from her metal mines in 1923 will exceed by over 50 per cent that of 1922.

UTAH

New Ore at Emma Silver Mine

A strike on the 700 level of the Emma Silver mine at Alta, is attracting attention inasmuch as the ore is thought to be a continuation of an old orebody lost through faulting. The ore is of shipping grade, with an exceptionally rich streak. It has been followed 20 ft. The Emma Silver mine has been through a number of vicissitudes since its period of productivity in the past. Its revival under the auspices of William Graham Rice in recent years is well known. Under that regime it produced some $200,000 worth of ore, and considerable work was done. Since then a number of Alta properties have been combined under the title of the Alta Merger, under the direction of George H. Watson. The Emma mine is now being actively developed under the new management.

Park City Companies Pay Dividends

The Park City Mining & Smelting Co. and the Park-Utah Mining Co., both under the direction of G. W. Lambourne, will pay dividends on Oct. 1, the former at the rate of 12½c. per share, and the latter at the rate of 15c.

CALIFORNIA

San Francisco Correspondence

Is William Fessel Alive?

Efforts made by a local newspaper to spread a report that William Fessel, supposed victim of the Argonaut disaster, whose body has not been recovered, has been seen alive are generally discredited by the mine management of the Argonaut. The belief is held that Fessel perished in the mine and that his body will be recovered when certain caved portions of the mine have been cleared out.

Mammoth Expected to Resume

A force of men is employed at the Mammoth mine and smelter at Kennett in repair work preliminary to resuming mining operations. As yet no announcement of plans has been made but it is believed that both mine and smelter will be operated in the near future. The U. S. Smelting company controls the Mammoth, Balaklala and other mining ground in the vicinity but has until recently refrained from operating these properties due to unstable metal markets.

No Move by Shasta Zinc & Copper Co.

The Shasta Zinc & Copper Co. at Winthrop is still idle. After a large expenditure upon a zinc and copper plant and the operation of this plant for a time, the company shut down after producing a considerable quantity of zinc oxide. Subsequently this oxide was all sold. The coast market for zinc oxide appears to be able to absorb any further production, but the company hesitates to resume operations.

ARIZONA

Asbestos Mine Will Not Reopen

H. E. Hacker, formerly manager for the Regal Asbestos Mining Co., whose property is located in northern part of Gila County, has stated that there is no immediate prospect for a reopening of the Regal mine. Competition by Canadian asbestos producers, it is considered, will prevent a general resumption of Arizona asbestos mines, the eastern producers being favored with cheaper production and cheaper freight rates to eastern buyers. There has been much said in Arizona in favor of the proposed tariff on the Canadian product and if some protection against that and African fiber could be effected, it is thought that a market could be developed for the local product.

Radio Communication for Far-North Mining Camps

THE Canadian Government will establish wireless communication between the Mayo silver camp in the Yukon territory and Dawson by the end of the year. Major W. A. Steel of the Canadian Signal Corps is en route from Ottawa to Dawson, where the first wireless station will be erected. It is proposed next year to erect a chain of radio stations in the Mackenzie River valley connecting with Dawson, the most Northern station being at Aclavic on Mackenzie Bay. This will give communication from the Yukon to Alberta via McMurray.

OREGON

A. S. & R. Buys Blue Ledge Property

The Blue Ledge copper mine, about 45 miles southwesterly of Gold Hill, and consisting of a large body of copper pyrites has been purchased from the Mexican Smelting & Refining Co. (controlled by the Robert S. Towne estate) by the American Smelting & Refining Co. Operation of the mine depends on the transportation facilities. There is a wagon haul of 35 miles to Jacksonville, the nearest shipping point. This property was a heavy shipper of 12 per cent copper ore all during the war and until the copper mines closed down generally.

MONTANA

Special Butte Correspondence

Gold Reported Under Lava Cap

The Lava Cap Gold Mining Co., which is controlled by California interests, is drilling near Virginia City, the one-time famous placer gold-producing area, in search of the "mother lode." The contention of the geologist of the company is that a late eruption of lava made a cap that covered the original head of the famous Alder gulch. It is reported that samples taken from the drill hole at a depth of 250 ft. show some gold content.

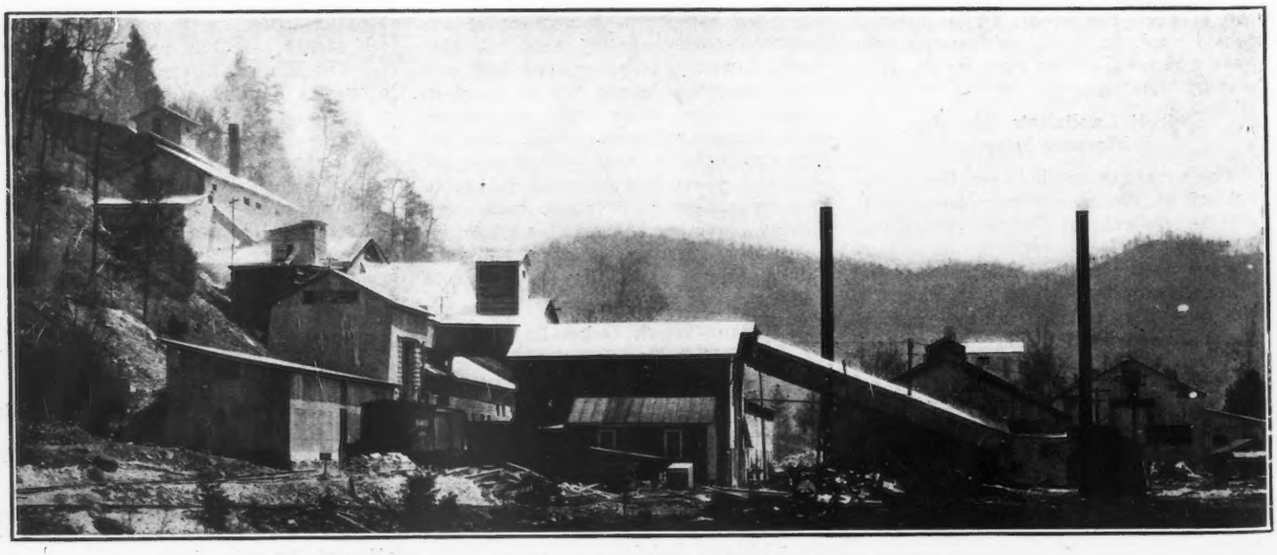
Mount Washington Ships

The Mount Washington mine, one of well-known properties of the Wickes district, has resumed operations after a shutdown of several months, and is now shipping ore to the East Helena smelter. When this mine was formerly operated the ore was treated in a small mill on the property, where a zinc-lead-silver separation was made. This plant was recently destroyed by fire.

Tailings Did Not Close Channel Says Court

A verdict for the defense was returned by the jury in the suit of W. J. Walsh against the East Butte Copper Co. Walsh brought suit against the mining company for damages resulting from the flooding of his premises on June 28, 1920. He also charged that the company was responsible for the filling of the channel of Silver Bow Creek with tailing. He asked for $9,000 damages.

The case was tried in the district court, then went to the supreme court, and from there it was sent back to the district court for retrial. The verdict of the jury says, in effect, that the channel of Silver Bow Creek has been filled not by tailing from the East Butte concentrator but by the erosion of the banks, this being the theory of the defense, supported by samples covering the bed of the stream for miles.



Feldspar mill of the Clinchfield Products Co. at Erwin, Tenn.

IDAHO

First National Has Good Showing in Coeur d' Alene

A 4-ft. face of ore containing silver chloride and some gray copper, has been opened in the lower tunnel of the First National Silver mine, near Wardner, according to L. L. Brainard. The scene of the discovery is 400 ft. west of the surface shaft on the Diamond claim. Development is progressing, and the region will be explored thoroughly within the next few months. A crosscut has been extended south for 115 ft.

Small Mill for Eldorado

A small concentrator is to be installed in the Eldorado property east of Kellogg. Ground has been broken. Fred Tolson and his associates, of Portland, Oregon, recently took over a three-year lease on a 15 per cent royalty basis on the property and will at once erect and install a first unit of 10-ton capacity. A new compressor has been ordered and other equipment will be added as rapidly as required.

NEVADA

Silver Pick Shaft Retimbered

Operations of the Silver Pick Consolidated Mining Co. on leased ground of the Goldfield Consolidated will be discontinued, and the company will confine its activities to deep work on its own main shaft and to the development of the Kennedy-Carmack discovery, two miles east of town. The miners who have been employed in the lease work on the Red Top will be employed at the Kennedy-Carmack shaft. The main shaft of the Silver Pick Co., a short distance from the Goldfield Consolidated west boundary, has been retimbered to the 700 level, and according to recently announced plans, an old crosscut on the 1,100 level will be reopened to further explore a wide vein, which is said to have assayed up to $12 per ton. This shaft is 1,300 ft. deep.

Simon Silver-Lead Develops South Vein

At the Simon Silver-Lead mine the raise from the 400 level has been driven a distanee of 80 ft. in the South vein, and stoping at this point has been begun. On the 475 level the fault on the east flattened and the crosscut entered the orebody in the fault. The heading cut ore assaying 16 oz. silver and 35 per cent lead with little zinc. The plant is back again to normal tonnage of 250 tons per day. A shortage of miners has retarded development on the 500 level.

Good Hope Mill to Be Rebuilt

The mill of the Good Hope mine recently destroyed by fire will be rebuilt in the near future, according to owners, who say they have disposed of the property to a syndicate of Elko people who take charge Sept. 1. A recent sampling shows that there is more than $75,000 in gold and silver in the dumps, according to R. K. Humphrey, who examined the property.

Extension Has Anchor Vein on 2,000 Level

John G. Kirchen, general manager of the Tonopah Extension Mining Co., has confirmed the report that the Anchor vein has been cut on the 2,000 level of the Victor shaft. It is said that where cut by the crosscut the vein showed a width of 6 ft. and assayed $60 per ton. The vein was first cut at 1,800 ft.

MICHIGAN

Ironton Mine Will Enlarge Stocking Trestle

Shipments of ore from the stockpiles of the Ironton mine of the McKinney Steel Co. have ended for the season, unless orders are changed. Only a small part of the ore in stock last spring has been shipped, and there is therefore little room for stocking more ore this winter. To avoid curtailment it is planned to enlarge the stockpile grounds. With the type of permanent stockpile trestle in use at this mine larger area is required to stock a given tonnage than with the old style of temporary trestle, which could be built to fill in odd corners.

Seneca Ready For Production

Seneca, in the Michigan copper district, which soon will begin regular production, is equipped to handle rock quickly and economically. Electric locomotives will pull a train of loaded cars from stopes and drifts to the shaft, where the rock will be dumped into pockets. The skips will be loaded automatically. There are two pockets at each station, one for good and the other for poor rock. As little poor rock as possible will be handled and only enough will be taken out to facilitate the mining of rock averaging well in copper content.

Mexican Miners Obtained

The Quincy Mining Co. has employed thirty Mexican miners who have had experience mining in Arizona. If these prove satisfactory more will be obtained.

MINNESOTA

Oliver Company Will Reopen McEwens-Higgins Mine

Plans for the reopening of the McEwens-Higgins property at Virginia have been completed by the Oliver Iron Mining Co. and it is anticipated that production will start by Jan. 1. The property has been closed since 1911 and was formerly worked by open pit and underground methods. Complete electrification of the surface plant and underground workings has been planned. Besides the shaft will be relined with poured concrete and a steel headframe will replace the wooden structure. At present the mine is filled with water and the accumulation of 100,000,000 gal. will be removed by electric pumps placed in the pit. This unwatering of the workings and other changes should be completed by Dec. 1. On an operating basis the mine will employ about 120 men.

A steam shovel on caterpillar tractors working at Virginia, Minn.

New Screening Pit at Buhl

A new screening plant is to be erected by the Tod-Stambaugh Co. at their Dean open pit mine at Buhl. The work is to be started in the near future and the plant when completed will have a capacity of 80 to 100 cars a day. The plant is to serve for a quantity of rocky material that has been encountered in the open pit.

ARKANSAS

Cushman Benefits from Stimulated Manganese Mining

Since the recent advance in the market price the manganese industry in Independence County has experienced a great revival. Old mines are being worked and several new mines are being developed. Among the promising new enterprises is the Hanford mine located near Cushman which is operated by R. S. Hanford. He has a large force of men at work and is getting out several carloads of ore a day. Cushman, in the heart of the manganese district, is experiencing a business revival.

THE MARKET REPORT

Daily Prices of Metals

Aug.	Copper, N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
6	13.50	41.375	41.875	6.80	6.70@6.75	6.55
7	13.50	41.50	42.00	6.80	6.70@6.75	6.50@6.55
8	13.50	41.625	42.125	6.80	6.70@6.75	6.50@6.55
10	13.50	41.50	42.00	6.80	6.70@6.75	6.50@6.55
11	13.50	41.625	42.125	6.80	6.70@6.75	6.50@6.55
12	13.50	41.625	42.125	6.80	6.70@6.75	6.50@6.55
Av.	13.50	41.542	42.042	6.80	6.725	6.529

*These prices correspond to the following quotations for copper delivered: Sept. 6th to 12th inclusive, 13.75c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

The quotations are arrived at by a committee consisting of the market editors of *Engineering and Mining Journal-Press* and a special representative of the Bureau of Mines and the Bureau of Foreign and Domestic Commerce.

London

Sept.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
6	64¼	65	60¼	200¼	201½	26	25¾	33⅞	33½
7	64⅛	64⅞	69¼	201	202¼	25⅞	25⅝	34	33½
10	63⅞	64½	69¼	199	200¼	25⅝	25⅜	33⅝	33½
11	63¾	64⅜	69¼	198½	199⅞	25¼	25	33⅝	32⅞
12	63¼	64	69	199¼	200	25¾	25⅜	33¾	33

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Sept.	Sterling Exchange "Checks"	Silver		Gold London	Sept.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
6	4.51⅝	63⅛	31 5/16	91s 2d	10	4.52¾	63¾	31½	90s 10d
7	4.52¾	63¼	31⅝	91s 2d	11	4.55	64⅛	31⅝	.....
8	4.53	63½	31⅞	.....	12	4.54⅜	63¾	31 7/16	90s 6d

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-quarter of a cent premium.

Metal Markets

New York, Sept. 12, 1923

The metal markets have been in a state of expectancy over the possibilities of a settlement in the Ruhr. Copper producers in particular have been anxiously watching the European developments as the prosperity of their industry is involved in the demand for the metal from abroad. The lead market is even stronger than it was last week. Sales of zinc have been fair, at practically unchanged prices. Some of the heaviest sales of the year were made in the tin market during the last few days. Of minor products, arsenic showed a pronounced jump upward to over 11c. per lb.

Copper

By far the largest sales for the week were made at 13.75c. delivered. A few were consummated at 13.875c. but in smaller lots. The copper market as a whole showed only a moderate consuming demand although producers generally report a better feeling. This may have been brought about by the good showing that was made in August, with deliveries of metal only exceeded by those made during part of last spring. On the strength of this one copper producer raised his price to 14c. but admitted that he was above and out of the market. Copper can be readily obtained today at 13.75c., in fact, we have heard of a sale at 13.675 to 13.70c. delivered. Dealers have played an important part in the business that was done this week. It was thought that the rumors of a Franco-German settlement would cause the London market to rise. Hence, there was considerable disappointment yesterday when it registered a decline. This is accounted for by the inference that London may have already discounted the favorable news from the Continent. Export business has been good, so much so, that at least one company was contented with its allotment of Copper Export Association sales and did not participate actively in the domestic market. Competition is extremely keen between the Association and non-members for the favor of European consumers. Prices abroad are on a close parity with those in the United States.

Lead

The official contract price of the American Smelting & Refining Co. remains 6.75c. per lb., New York.

Sales of lead have been excellent. In both New York and St. Louis demand was active and the buying wave that has characterized the lead market for several weeks continues unabated. As high as 6.75c. was realized in St. Louis but most of the sales fall in the range of 6.70 to 6.75c. Supplies of spot metal are scarce in New York and forward lead is also none too easy. Today a price of 7c. per lb. was paid for a fair sized lot of New York lead for November shipment. Stocks in the hands of producers are equivalent to about one week's production. Consumption of lead by storage battery manufacturers is better.

Lead is in good demand in Europe. Spanish production has decreased owing, perhaps, to the leanness of the ore handled and perhaps to labor troubles. Australian production has been affected by a fire in one of the principal lead mines on that continent. Mexican output is running close to 16,000 tons per month with most of it going abroad. The strike of dock workers in London has made it difficult to provide satisfactory transportation for the metal as the ships do not like to dock there.

Zinc

The slab zinc market has not changed much, so far as prices are concerned, which fluctuated between 6.50 and 6.55c. per lb. E. St. Louis during the week. The report of the American Zinc Institute for August shows an increase in stocks. Production for the month was

41,625 tons; shipments, 36,394; stock on hand Aug. 1, 21,240; on Aug. 31, 26,471 tons; shipped from plant for export, 1,016 tons. The heavy export business of August will probably be reflected in the September statistics as it was done too late in the month to show up in the August compilations. Galvanizers have evinced a greater interest in the market since the Japanese earthquake. They may be preparing for business from that quarter although some producers feel that European galvanizers make a product with which it will be difficult to compete. No matter who ultimately receives the galvanizing trade of Japan, American zinc producers should benefit directly or indirectly.

Buying of ores in the Joplin market was heavy last week—18,000 tons was purchased. The profit for smelters in the present ore market is not large with the price of Prime Western around 6.55c. Some Brass Special was sold yesterday at a 12½ point premium over the price of Prime Western. High grade metal is in good demand, at unchanged prices—8 to 8½c. per lb.

Tin

Buying of tin by American consumers has been excellent. Tin plate manufacturers opened their books for fourth quarter business and bought unusually large tonnages of the metal. It is reported that even the Far East unloaded some of the stocks which it has on hand to the extent of 2,500 tons. The London market is now close to £200 per ton the price at which most of the stocks were being held.

Arrivals of tin in long tons: Sept. 4, Java, 200; 5, Liverpool, 125; China, 75; 6, London, 25; Straits, 30; 7, Straits, 350; China, 50; 10, Hamburg, 25; Liverpool, 250.

Foreign Exchange

On Tuesday, Sept. 11, cable quotations on francs were, 5.79c.; lire, 4.47c.; and Canadian dollars, 2$\frac{3}{32}$ per cent discount.

Silver

During the last week the Indian bazaars have been good buyers both in London and New York, while China has operated on both sides of the market abroad. Buying predominated, however, with the result that prices advanced, a new high level for the past few months having been established in New York on Sept. 11. The market closes steady.

Mexican Dollars—Sept. 6th 48$\frac{1}{8}$, 7th, 48$\frac{3}{8}$; 8th, 48$\frac{3}{8}$; 10th, 48$\frac{3}{8}$; 11th, 48$\frac{7}{8}$; 12th, 48$\frac{7}{8}$.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—99 per cent grade, 26@27c. per lb.; 98 per cent, 25@26c. London, £115.

Antimony—Chinese and Japanese brands 7$\frac{1}{8}$@7$\frac{3}{8}$c. W.C.C. brand, 8$\frac{1}{8}$c. Cookson's "C" grade, 10.25@10.50c.

Bismuth—$2.55 per lb. London, 10s.

Cadmium—$1 per lb. London, 4s. 6d.

Cobalt—$3 per lb. for spot.

Iridium—$275@$300 per oz.

Nickel—27@32c. per lb. for 99 per cent virgin metal. London, £125@£130 long ton.

Palladium—$80 per oz.

Platinum—$116 per oz. London, £24 15s.@£25.

Quicksilver—$64 per 75-lb. flask. Quiet. San Francisco wires $60.65 London, £9.

The prices of **Magnesium, Molybdenum, Monel Metal, Osmium, Radium, Rhodium, Selenium, Tellurium, Thallium,** and **Tungsten** are unchanged from prices given Sept. 8.

Metallic Ores

Chrome, Iron Ore, Magnetite, Manganese, Molybdenum, Titanium, Tungsten, Vanadium, and **Zircon Ore** are unchanged from the quotations published Sept. 8.

Zinc and Lead Ore Markets

Joplin, Mo., Sept. 8—Zinc blende, per ton, high, $42.90; basis 60 per cent zinc, premium, $41; Prime Western, $40; slimes and fines, $37@$38; average settling price, all zinc ores, $41.11.

Lead, high, $86.75; basis 80 per cent lead, $85; average settling price, all lead ores, $81.36 per ton.

Shipment for the week: Blende, 13,286; lead, 1,234 tons. Value, all ores the week, $646,570.

Demand strengthened sharply this week, and buyers began purchasing ore on $40 basis in mid-week, resulting in a total purchase of 17,890 tons. Some sellers declined the $40 basis until today, finally accepting offerings on that basis.

Platteville, Wis., Sept. 8—Blende, basis 60 per cent zinc, $42.50 per ton. Lead, basis 80 per cent lead, $85 per ton. Shipments for the week: Blende, 435 tons; lead, 30 tons. Shipments for the year: Blende, 21,363; lead, 530 tons. Shipments for the week to separating plants: 966 tons blende.

Non-Metallic Minerals

Asbestos—Crude No. 1, $375@$500; No. 2, $250@$300; spinning fibers, $150@$200; magnesia and compressed sheet fibers, $90@$135; shingle stock, $50@$65; paper stock, $35@$40; cement stock $20@$25; floats, $8@$15. All f.o.b. mines, per short ton, Quebec.

Barytes, Bauxite, Borax, Chalk, China Clay, Diatomaceous Earth, Emery, Feldspar, Fluorspar, Fuller's Earth, Graphite, Gypsum, Limestone, Magnesite, Manjak, Mica, Monazite, Phosphate, Pumice, Pyrites, Silica, Sulphur, Talc and Tripoli are unchanged from the Sept. 8 prices.

Mineral Products

Arsenic—The market is 11@11½c. per lb. for all positions through next March. Heavy tonnages were sold during the week. One of the leading producers is now out of the market. The possibility of Japanese shipments to the United States being curtailed caused the advance. Some arsenic has even been shipped abroad. The market is strong.

Copper Sulphate—5.10@5.25c. per lb., domestic product.

Sodium Nitrate—$2.45 per 100 lb., ex vessel, Atlantic ports.

Potassium Sulphate and Sodium Sulphate are unchanged from quotations of Sept. 8.

Ferro-Alloys

Ferrosilicon—50 per cent, $85.

Ferrotungsten—88@95c. per lb. of contained W, f.o.b. works.

Ferrocerium, Ferrochrome, Ferromanganese, Ferromolybdenum, Ferrotitanium, Ferro-uranium and **Ferrovanadium** are unchanged from the prices published Sept. 8.

Metal Products

Copper—Sheets, 22¼c. base; wire, 16@16¼c.

Nickel Silver—18 per cent Grade A sheets, 28½c.

Yellow Metal—Dimension sheets, 19½c.; rods, 16½c.

Zinc Sheets—Base price, $9.25 per 100 lb., f.o.b. plant.

Lead Sheets—Cut, 10.25c.; full 10.50c. per lb.

Refractories

Bauxite Brick, Chrome Brick, Firebrick, Magnesite Brick, Magnesite Cement, Silica Brick and **Zirkite** are unchanged from the Sept. 8 prices.

The Iron Trade

Pittsburgh, Sept. 11, 1923

Steel ingot production in August was at an average rate of 42,400,000 tons a year, 3.1 per cent below the July rate and 13.5 per cent below the peak rate of April. Production was declining and may not be at much above 40,000,000 tons now.

The Steel Corporation's unfilled obligations decreased by 496,100 tons during August, to 5,414,663 tons. In the past three months the corporation's bookings have averaged a trifle over 50 per cent of capacity, with shipments averaging about 90 per cent, but declining slightly. As independents can make earlier deliveries their bookings have been running somewhat above those of the corporation, but their shipments are less as they entered the dull spell with less forward business.

Pig Iron—A few additional merchant furnaces are going out, having piled iron. Buying is increasing slightly. Prices remain: Bessemer, $26.50; basic, $25; foundry and malleable, $25@$26, f.o.b. valley furnaces, $1.77 freight to Pittsburgh.

Connellsville Coke—Spot or prompt: Furnace, $5@$5.25; foundry, $6@$6.50; heating, $4.75.

Freight Rates on Metals, Ores, and Concentrates

In Carload Lots

Copper Bullion and Refined Copper

From	To	Rate per Ton of 2,000 Lb. All Rail	Via Gulf
El Paso, Tex.	Baltimore, Md.	$13.40	.....
Garfield, Utah	Perth Amboy, N. J.	*12.50	.....
Garfield, Utah	San Francisco	5.85	.....
Hayden, Ariz.	Perth Amboy, N. J.	16.50	$*12.50
Miami, Ariz.	Perth Amboy, N. J.	16.50	*12.50
Anaconda, Mont.	Perth Amboy, N. J.	*12.50	.....
Butte, Mont.	Perth Amboy, N. J.	*12.50	.....
Humboldt, Ariz.	Chrome, N. J.	16.50	*12.50
Douglas, Ariz.	Perth Amboy, N. J.	16.50	*12.50
Globe, Ariz.	Perth Amboy, N. J.	16.50	*12.50
Clifton, Ariz.	Perth Amboy, N. J.	16.50	*12.50
Clarkdale, Ariz.	Chrome, N. J.	16.50	*12.50

From	To	Rate per Ton of 2,000 Lb. All Rail	Via Gulf
Copperhill, Tenn.	Laurel Hill, N. Y.	$10.80	.....
Tooele, Utah	Chrome, N. J.	*12.50	.....
McGill, Nev.	Baltimore, Md.	15.90	.....
Houghton, Mich.	New York	(a) 9.60	.....
Hancock, Mich.	New York	(a) 9.60	.....
Hubbell, Mich.	New York	(a) 9.60	.....
Dollar Bay, Mich.	New York	(a) 9.60	.....
Tacoma, Wash.	New York Conference rate	$6.00 via Canal	
Anaconda, Mont.	Tacoma, Wash.	7.09	.....
Ajo, Ariz.	New York	16.50	*12.50

(a) Applies April 1 to Nov. 30 of each year.

Lead Bullion; (Pig Lead Where Shown)

From	Rates per Ton of 2,000 Lb. To New York	To St. Louis
East St. Louis, Ill.	$7.00	.....
Pueblo, Colo.	14.15	$9.65
Leadville, Colo.	16.50	11.40
East Helena, Mont	16.50	11.40
El Paso, Tex.	(c) 12.00 Via Gulf	
	(c) 14.00 All Rail	(b) 7.76½
Omaha, Neb.	9.60	3.65
Murray, Utah	16.50	11.40
Midvale, Utah	16.50	11.40
Tooele, Utah	16.50	11.40
East Chicago, Ill.	6.40	(a) 2.00
Kellogg, Idaho	16.50	11.40
Carnegie, Pa.	3.80	(a) 5.00
Selby, Calif.	(d) 6.00	.....
Herculaneum, Mo.	(a) 8.80	(a) 1.80
Federal, Ill.	7.00	(a) 1.80
Collinsville, Ill.	7.00	(a) .75½
Granby, Mo.	(a) 10.50	(a) 3.50
Joplin, Mo.	(a) 10.50	(a) 3.50

(a) Pig lead only.
(b) Pig lead only when originating in Mexico.
(c) Shipments of bullion originating in Mexico, $2 per ton less.
(d) Conference rate, via canal.

Zinc

From	Rates per Net Ton to E. St. Louis	New York
Donora, Pa.	(a) $4.60	$3.80
Langeloth, Pa.	(a) 4.60	3.80
Palmerton, Pa.	*7.10	3.00
Hillsboro, Ill.	1.40	7.00
Danville, Ill.	2.00	6.40
La Salle, Ill.	2.00	6.70
Springfield, Ill.	3.00	7.00
Cleveland, Ohio	5.80	*5.00
Moundsville, W. Va.	4.40	3.80
Van Buren, Ark.	3.80	10.80
Fort Smith, Ark.	3.80	10.80
Bartlesville, Okla.	3.50	10.50
Blackwell, Okla.	3.80	10.80
Henryetta, Okla.	3.80	10.80
Sand Springs, Okla.	3.80	10.80
Cherryvale, Kan.	3.50	10.50
Black Eagle, Mont.	*9.40	*12.50
Park City, Utah	9.00	*12.50

(a) To St. Louis, Mo.

Zinc Ores and Concentrates

To	From	Rate per Net Ton
Bartlesville, Okla.	Altoona, Kan.	$2.10
	Pittsburg, Kan.	1.10
	Galena, Kan.	1.30
	Joplin, Mo.	1.40
	Iola, Kan.	1.10
	Baxter, Kan.	1.40
	Miami, Okla.	1.40
	Quapaw, Okla.	1.40
	Kansas City, Mo.	1.60
Sand Springs, Okla.	Miami, Okla.	2.20
	Quapaw, Okla.	2.20
	Galena, Kan.	1.50
	Joplin, Mo.	1.50
	Iola, Kan.	2.40
	Cave Springs, Mo.	2.00
	Cent City Spur, Mo.	2.00
Dewar, Okla.	Chitwood, Mo.	2.00
Kusa, Okla.	Galena, Kan.	1.50
Henryetta, Okla.	Iola, Kan.	2.40
	La Harpe, Kan.	2.40
La Harpe, Kan.	Mound City, Kan.	.50
	Oswego, Kan.	.50
	Parsons, Kan.	.50
Coffeyville, Kan.	Galena, Kan.	1.10
	Joplin, Mo.	1.22
	Baxter, Kan.	1.80
Bartlesville, Okla. (a)	Miami, Okla.	1.80
	Quapaw, Okla.	1.80

(a) Lead ore and concentrates.

Rates on Ores and Concentrates

From	To	Value of Product: $5	$10	$15	$20	$25	$30	$35	$40	$50	$60	$70	$75	$80	$90	$100
		Rate														
Butte, Mont.	Anaconda, Mont.	.17	.17	.17	.17	.17	.17	.17	.17	.17	.17	.17	17	.17	.17	.17
Butte, Mont.	Black Eagle, Mont. (a)	....	....	....	....	....	....	....	1.01	....	....	....	....	....	....	....
Great Falls, Mont.	East Helena, Mont.	....	....	1.57	....	1.76	....	1.98	....	2.43	....	....	....	....	....	2.5
Butte, Mont.	East Helena, Mont.	....	....	1.17	....	1.46	....	1.69	....	2.03	....	....	....	....	....	2.14
Paxton, Calif.	Salt Lake Smelters, Utah	....	....	....	....	....	....	....	....	6.30	7.00	7.70	....	8.35	8.60	8.85
Johannesburg, Calif.	Selby, Calif.	....	....	....	2.90	....	3.50	....	4.10	4.70	5.30	5.90	....	6.50	6.80	7.10
Johannesburg, Calif.	Humboldt, Ariz.	....	....	....	3.40	....	4.10	....	4.80	5.50	6.20	6.90	....	7.60	8.00	8.30
Pioche, Nev.	Humboldt, Ariz.	....	4.50	(c) 7.74	....	8.55	....	9.36	....	9.99	....	....	11.25	....	....	12.42
Creede, Colo.	Durango, Colo.	....	....	3.25	3.50	3.75	4.00	....	4.25	4.75	5.25	5.75	6.05	....	....	7.10
Ouray, Colo.	Durango, Colo.	....	....	4.30	4.80	....	5.05	....	....	5.90	....	6.30	....	....	....	7.70
Kokomo, Colo.	Durango, Colo.	....	6.00	....	....	6.50	7.20	....	....	....	....	....	....	....	....	....
Telluride, Colo.	Durango, Colo.	....	....	....	....	....	4.30	....	5.00	5.90	6.30	6.30	....	....	....	7.70
Silverton, Colo.	Durango, Colo.	....	....	1.40	1.40	....	....	2.20	....	....	2.30	2.55	....	2.80	....	2.80
Tyrone, N. M.	Douglas, Ariz.	....	....	1.60	1.90	....	2.20	....	2.50	2.80	....	....	3.40	....	....	3.80
Tyrone, N. M.	El Paso, Tex.	....	....	1.60	1.90	....	2.20	....	2.50	2.80	....	....	3.40	....	....	3.80
Lordsburg, N. M.	D uglas, Ariz.	....	1.00	1.30	1.60	....	1.90	....	2.20	2.50	....	....	2.80	....	....	3.40
Lordsburg, N. M.	El Paso, Tex.	....	1.00	1.30	1.60	....	1.90	....	2.20	2.50	....	....	2.80	....	....	3.40
Tombstone, Ariz.	Douglas, Ariz.	....	....	.60	....	.90	....	....	....	1.30	....	....	1.60	....	....	1.90
Tombstone, Ariz.	El Paso, Tex.	....	....	1.90	....	2.50	....	....	....	3.80	....	....	4.40	....	....	4.40
Silver City, N. M.	Douglas, Ariz.	....	....	2.48	....	3.15	....	....	....	3.83	....	....	....	....	....	5.29
Ray Junction, Ariz.	Hayden, Ariz.	....	.10	....	.40	....	.50	....	.80	.90	....	....	1.00	....	....	1.10
Sandon, B. C. / Alamo Concentrator, B. C.	Tadanac, B. C.	1.50	1.60	1.70	1.90	2.00	2.50	....	2.60	2.90	3.40	3.50	....	3.70	3.80	3.90
Rossland, B. C.	Tadanac, B. C.	.90	.90	1.00	1.00	1.10	1.50	....	1.60	1.60	1.60	1.70	....	1.70	1.70	1.70
Rossland, B. C.	Tadanac, B. C. (d)	.30	.30	.30	.30	.50	.70	....	.80	.80	....	....	....	....	....	....
Republic, Wash.	Tadanac, B. C.	....	2.02	2.50	2.66	2.86	3.84	....	3.84	3.84	4.69	4.89	....	5.19	5.39	5.59

(a) Minimum tonnage of 200 tons per day. (b) In open cars, minimum 80,000 lb. (c) Siliceous ore tailing.
(d) Applicable on ore, only when shipped in trainload lots of not less than 10 cars and exclusive of switching charges at Rossland.

Rates on Ores and Concentrates

From	To	Value of Ores and Concentrates: $10	$15	$20	$25	$30	$35	$40	$50	$60	$70	$75	$80	$90	$100
		Rate													
Burke, Idaho	Bradley, Idaho	....	....	....	....	....	....	....	....	.68	....	....	....	....	1.02
Burke and Wallace, Idaho	East Helena, Mont.	....	....	....	....	3.00	....	3.25	3.50	3.75	4.00	.....	4.25	4.50	4.75
Sagel, Idaho	East Helena, Mont.	....	....	....	3.38	....	3.83	....	4.16	....	....	.....	....	.....	4.84
Arizona Tunnel, Idaho	Bradley, Idaho	....	....	....	....	....	....	....	....	.35	....	.....	....	.....	.50
Bayview, Idaho	Bradley, Idaho	....	....	....	....	....	....	....	3.75	....	....	4.37½	....	.....	5.12½
Park City, Utah	Salt Lake Smelters	1.00	1.10	1.25	....	1.50	....	1.75	....	2.00	....	.....	2.25	.....	2.50
Eureka, Utah	Salt Lake Smelters	1.00	....	1.25	....	1.50	....	1.75	2.00	2.25	2.50	.....	2.75	3.00	3.25
Tintic, Utah	Salt Lake Smelters	1.00	....	1.25	....	1.50	....	1.75	2.00	2.25	2.50	.....	2.75	3.00	3.25
St. Johns, Utah	Salt Lake Smelters	1.00	....	1.25	....	1.50	....	1.75	2.00	2.25	2.50	.....	2.75	3.00	3.25
Ophir, Utah	Salt Lake Smelters	1.00	....	1.25	....	1.50	....	1.75	2.00	2.25	2.50	.....	2.75	3.00	3.25
Bingham, Utah	Garfield, Utah	....	.40	....	.75	....	....	....	.95	....	....	1.10	....	....	1.25
Cherry Creek, Nev.	Garfield, Utah (c)	....	....	4.60	....	5.10	....	5.60	6.10	6.60	7.10	.....	7.60	8.10	8.60
Cherry Creek, Nev.	Garfield, Utah (b)	....	....	3.20	....	3.90	....	4.60	5.30	6.00	6.70	.....	7.40	....	....
Goldfield, Nev.	Salt Lake Smelters	....	....	5.10	....	5.80	....	6.50	7.20	7.90	8.60	.....	9.30	10.00	10.70
Battle Mountain, Nev. (a)	Salt Lake Smelters	....	....	3.20	....	3.80	....	4.40	5.00	5.60	6.20	.....	6.80	7.40	8.00
Palisade, Nev. (a)	Salt Lake Smelters	....	....	3.20	....	3.80	....	4.40	5.00	5.60	6.20	.....	6.80	7.40	8.00
Mina, Nev. (a)	Salt Lake Smelters	....	....	3.60	....	4.30	....	5.00	5.70	6.40	7.10	.....	7.80	8.50	9.20
Lovelock, Nev. (a)	Salt Lake Smelters	....	....	3.20	....	3.90	....	4.60	5.30	6.00	6.70	.....	7.40	8.10	8.80
Golconda, Nev. (a)	Salt Lake Smelters	....	....	3.20	....	3.90	....	4.60	5.30	6.00	6.70	.....	7.40	8.10	8.80
Hazen, Nev. (a)	Salt Lake Smelters	....	....	3.20	....	3.90	....	4.60	5.30	6.00	6.70	.....	7.40	8.10	8.80
Tonopah, Nev.	Salt Lake Smelters	....	....	5.10	....	5.80	....	6.50	7.20	7.90	8.60	.....	9.30	10.00	10.70
Rogerson, Idaho	Salt Lake Smelters	3.00	....	3.50	....	4.00	....	4.50	5.00	5.50	6.00	.....	6.50	7.00	7.50
Georgetown, Colo.	Leadville, Colo.	....	....	3.50	....	3.75	....	4.00	5.00	5.00	5.80	.....	5.80	5.80	5.80
Shirley, Colo.	Leadville, Colo.	....	....	2.25	....	2.25	....	2.25	2.25	4.30	4.30	.....	4.30	4.30	4.30

(a) Minimum weight, marked capacity of car used, but not less than 80,000 lb. (b) Minimum weight, 80,000 lb. (c) Minimum weight, 40,000 lb.
*Indicates a change of tariff since last report.

Overproduction or Underconsumption of Copper

Foreign Trade Featured by Heavy Imports—European Consumption Could Be Improved—Industry Hurt by Reparation Muddle

By Felix Edgar Wormser
Assistant Editor

THE COPPER MARKET, from the standpoint of the majority of American producers, is far from satisfactory. Prices close to 14c. delivered may enable some of them to work their properties at a profit but they hardly spell prosperity for the whole industry. For several months the copper market has shown most of its buying activities in the domestic branch of the trade, while export shipments have been only fair. In the meantime large tonnages of copper have been imported into the United States—their exact size can be seen from the following table:

Movements of Copper to and From the United States (a)

Period.	Imports	Exports	Net Exports
1912, monthly	34,212,000	65,416,000	31,204,000
1913, monthly	34,065,000	77,186,000	43,121,000
Jan., 1923	38,007,000	76,859,000	40,852,000
Feb., 1923	38,484,000	50,689,000	12,205,000
Mar., 1923	53,922,000	131,995,000	78,073,000
Apr., 1923	37,310,000	65,785,000	28,475,000
May, 1923	81,105,000	60,578,000	—20,527,000
June, 1923	64,756,000	63,185,000	1,571,000
July, 1923	53,357,000	64,348,500	10,991,000

(a) Bureau of Foreign and Domestic Commerce.

The figures of most significance in the table are those showing net exports of copper. They indicate an unusual situation—more copper came into the United States than left it during the month of May and in June only a handful of metal and in July about 11,000,000 lb. was the net export balance. This condition is sufficient to account for the low price of the metal today. In fact, the balance of copper exported has been lower on the average so far in 1923, than in pre-war years. The record discloses that the heavy shipments of foreign copper to this country have been responsible in great measure for the unsound foreign trade position.

European Consumption is Lagging

Consumption of copper in Europe has not kept pace with the consumption in the United States. American manufacturers of copper products are now able to take, and have done so in the past six months, record breaking amounts of copper—about twice as much as they consumed before the war. Whereas a demand amounting to 55,000,000 lb. monthly was considered excellent in 1912 and 1913, nowadays a consumption of 110,000,000 to 120,000,000 lb. of copper per month seems to be easily within the capacity of American copper and brass plants. The ability of the United States to use copper has kept pace with an increase in population, but, unfortunately, this cannot be said of Europe, where the failure to return to a real peace basis has retarded the growth of copper consumption. Copper exports are about on a prewar level as can be seen from the table. They should be much higher.

The large shipments of foreign copper, partly to American refineries, and partly to American consumers, have their origin in countries which did not figure so prominently as producers a few years ago. They are Chile, Peru, and the Belgian Congo. The following copper mining companies in these lands can readily turn out close to 37,000,000 lb. of copper per month:

	Estimated Monthly Rate of Production in Pounds
Chile Copper Co.	19,000,000
Union Miniere du Laut Katanga	11,000,000
Cerro de Pasco and subsidia ries	7,000,000

Chile and Katanga are comparative newcomers in the field. In 1914, Chile Copper had an output of 11,000,000 lb.; today it is producing at a rate of 220,000,000 lb. Katanga, the phenomenal African producer has made great strides in the last two years in point of copper output. Although Katanga's production during the war, and up to 1921 was about 4,500,000 lb. monthly all records were broken in July of this year, when over 12,000,000 lb. of copper was produced. A good proportion of this African metal is coming into the United States to be sold here or abroad. The cost of water transportation is low although the distance over which the metal has to travel is long. Katanga's main trouble is transportation to African seaports from the central part of the Continent. Nichols Copper Co., New York City, is the American agents for Katanga's output.

The Question of a Tariff

A means that might suggest itself for checking the heavy imports of copper would be to establish a protective tariff upon the metal. Arguments similar to those used in the case of wheat, zinc and other commodities could be used—cheap foreign labor, plentiful foreign resources, the protection of American labor, etc. But the domestic producers realize what the wheat growers have been unable to grasp, i.e. that a tariff upon their product would only deflect foreign output to foreign countries where it would compete with American supplies. This would result in depressing the foreign price, which, in turn, would influence the domestic market. Furthermore, the profit on refining or treating blister copper, mattes, and ores would be lost, as this business would go to European houses glad to obtain it. At the same time part of the refining capacity in the United States tuned to handle imported raw materials would become idle. Another important reason why a tariff upon copper is not desired is the fact that American capital is strongly interested in some of the companies most responsible for the influx of metal. To mention a few: Chile Copper, Greene Cananea, Cerro de Pasco, Braden, Granby Cons. and Phelps Dodge Mexican properties. A tariff upon copper would be a direct blow to these producers.

The greatest blessing that could be conferred upon the copper industry would be a settlement of Franco-German difficulties. Although this political trouble has seriously affected numerous trade relations its reaction upon business in the United States has generally been indirect. Business conditions have been better in our own country during the past twelve months than elsewhere despite the Ruhr. The copper market has, however, directly felt the consequence of the unstable conditions abroad. Germany has normally been the principal market for American copper in Europe and although there was good reason to think a few years ago, that this condition might change, and that other countries, notably France and Great Britain, would take her place, it appears now that Germany will remain the best foreign market. It is a striking commentary upon the vitality of German copper consumption that in the midst of almost vertical depreciation of the mark, imports of American copper into Germany have been continually greater than into any other country.

Germany A Good Market

If the reparations impasse were to be settled, that is, some definite sum determined within the capacity of the country to pay, and German industries given a breathing spell to get their plants in shape, German consumption of copper should rise by leaps and bounds. It cannot do otherwise, for to pay the huge sums demanded of her, Germany will have to become an exporting country to a far greater extent than before the war. She will therefore have to order raw materials in increased amounts and copper should receive its share of the improved business for it is important in many manufacturing lines.

Copper production in the United States shows no tendency to decrease although the profit for many producers in a 13 to 14c. market cannot be very large. At present it looks as if the copper companies are pursuing their individual policies as best they may, with the hope that they will be the ones to survive. Smelter production from American ores is about 120,000,000 per month, a merry rate considering the state of the market. The price of copper will have to drop greatly before it can influence some of the big low cost "porphyry" producers to quit. Only one mining company has lately given up trying to make copper—the North Butte Copper Mining Co. No others have shown a desire to follow suit. They manifest a pardonable inclination to take losses, if need be, rather than abandon all attempts to continue. Havoc wrought to an organization by a complete curtailment of operations is not easily remedied. The experiment that the copper mining industry tried a few years ago of shutting down almost completely was not a happy one, although it acheived its object of improving the market position.

MINING STOCKS

Week Ended September 8, 1923

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Ahmeek	Boston	61	59	59	June 23, Q	$1.50
Alaska-Br. Col.	N. Y. Curb	1¼	1¼	1¼		
Allouez	Boston	*16½	*15¾	*15	Mar. '19	1.00
Anaconda	New York	42	40½	40⅝	Se.15, Oc.22, Q	0.75
Arcadian Consol.	Boston	1¾	1¾	1¾		
Ariz. Com'l.	Boston	9½	9	9⅜	July '23,	0.50
Calaveras	N. Y. Curb			2		
Calumet & Arizona	Boston	49	48	48	June '23,	1.00
Cal. & Hecla (New)	Boston	41½	41¼	40	June '23, Q	10.00
Centennial	Boston	8	7	7	Dec. '18, SA	1.00
Cerro de Pasco	New York	41⅛	40	40	Jy. 19, Au. 1	1.00
Chile Copper	New York	27⅜	26¼	27¼	Se. 1, Se. 29, Q	0.62½
Chino	New York	17⅞	17⅛	17⅛	Sept. '20, Q	0.37½
Con. Coppermines	N. Y. Curb	2⅛	1⅞	1⅞		
Copper Range	Boston	29⅛	28⅛	28¼	May '23, Q	1.00
Crystal Copper	Boston Curb	60	58	59		
Davis-Daly	Boston	2 5/16	2⅛	2 5/16	Mar. '20, Q	0.25
East Butte	Boston	6	5⅝	5⅛	Dec. '19, A	0.50
First National	Boston Curb	30	30	30	Feb. '19, SA	0.15
Franklin	Boston			1¼		
Gadsden Copper	Boston Curb	60	50	51		
Granby Consol.	New York	19⅛	18⅛	18⅛	May '19, Q	1.25
Greene-Cananea	New York	18⅛	18⅜	18⅜	Nov. '20, Q	0.50
Hancock	Boston	2	2	2		
Howe Sound	N. Y. Curb	3⅛	3	3⅛	Jy. 2, Jy. 16	0.05
Inspiration Consol.	New York	29	28⅛	28¾	Se.13, Oc.1 Q	0.50
Iron Cap	Boston Curb	4	4	4	May 23, K	0.15
Isle Royale	Boston	22	21½	21⅜	Se. 1, Se. 15,	0.50
Kennecott	New York	35½	34½	34½	Se. 7, Oc. 1,	0.75
Keweenaw	Boston	*80	*80	*80		
Lake Copper	Boston	2	2	2		
Magma Copper	New York	30½	30	30	Jan. '19, Q	0.50
Mason Valley	N. Y. Curb	2	1⅞	2		
Mass Consolidated	Boston			1⅜	Nov. '17, Q	1.00
Miami Copper	New York	24½	23⅞	24	Se. Oc.1, Q	0.50
Michigan	Boston	2	2	2		
Mohawk	Boston	42½	42	42	Se. 22, Oc. 13,	1.00
Mother Lode Coa	New York	9⅜	9¼	9¼	Je. 8, Je. 30, Q	0.50
Nevada Consol.	New York	12⅜	11⅞	12¼	Sept. '20, Q	0.25
New Cornelia	Boston	17⅞	17⅝	17⅛	Au. 3, Au. 20, Q	0.25
North Butte	Boston	2⅝	2½	2⅝	Oct. '18, Q	0.25
Ohio Copper	N. Y. Curb	*67	*57	*60		
Old Dominion	Boston	18¼	16½	18½	Dec. '18, Q	1.00
Osceola	Boston	31⅜	31⅛	31½	June '23, Q	1.00
Phelps Dodge	Open Mar.	†160	†150		Je. 20, Jy. 2 Q	1.00
Quincy	Boston	27	26½	26	Mar. '20, Q	1.00
Ray Consolidated	New York	11⅛	10½	11	Dec. '20, Q	0.25
Ray Hercules	N. Y. Curb			*65		
St. Mary's Min. Ld	Boston	35	34⅛	34⅜	Mar. '23, K	3.00
Seneca Copper	New York	7⅞	7⅝	7⅝		
Shannon	Boston	*55	*55	*55	Nov. '17, Q	0.25
Shattuck Arizona	New York	7	7	7	Jan. '20, Q	0.25
South Lake	Boston			*98		
Superior & Boston	Boston	1	1	1		
Tenn. C. & C. cfs	New York	9⅜	8⅜	8⅜	Se. 29, Oc. 15, Q	0.25
Tuolumne	Boston	1⅜	1 3/16	1⅛	May '13,	0.10
United Verde Ex	N. Y. Curb	29	29⅛	29⅛	Se. 29, Oc. 15, Q	0.25
Utah Consol.	Boston	1½	1½	1½	Sept '18,	0.25
Utah Copper	New York	61	60	60	Je. 8, Je. 30, Q	1.00
Utah Metal & T	Boston	*60	*55	*55	Dec. '17,	0.30
Victoria	Boston	*75	*75	*75		
Winona	Boston	*60	*60	*60		
Wolverine	Boston	7⅛	6⅞	7		
NICKEL-COPPER						
Internat. Nickel	New York	13⅜	12¾	12¾	Mar.' 19,	0.50
Internat. Nickelpfd.	New York	80	80	80	Jy. 19, Au. 1	1.50
LEAD						
Carnegie Lead & Zinc	Pittsburgh			3⅞		
National Lead	New York	124½	117	123⅞	Se.16, Se.29 Q	2.00
National Lead pfd	New York	113¾	112⅜	113¼	Au. 24, Se. 15 Q	1.75
St. Joseph Lead	New York	19¼	18⅛	18⅜	Se.9, Se.20 Q, X	0.50
ZINC						
Am. Z. L. & S.	New York	8⅛	8⅛	8⅛	May '20,	1.00
Am. Z. L. & S. pfd	New York	34⅞	34⅞	34⅞	Nov. '20, Q	1.50
Butte C. & Z.	New York	6⅛	5⅜	5	Mar. '23,	0.50
Butte & Superior	New York	17⅜	15	15	Je. 15, Je. 30, Q	0.50
Callahan Zn-Ld	New York	5⅜	5	5⅜	Dec. '20, Q	0.50
New Jersey Zn.	N. Y. Curb	152	151	152	Jy.31, Au.10 Q	2.00
United Zinc	N. Y. Curb	*50	*50	*50		
Yellow Pine	Los Angeles			*62½	June '23, Q	0.03
SILVER						
Alvarado	N. Y. Curb			2⅛		
Batopilas Mining	New York			⅛	Dec. '07, I	0.12½
Beaver Consol.	Toronto	*34	*32½	*32½	May '20, K	0.03
Candelaria	N. Y. Curb	*6	*5	*6		
Castle-Trethewey	Toronto	*25½	*24	*25½		
Coniagas	Toronto	2.60	2.50	2.60	May '21, Q	0.12½
Crown Reserve	Toronto	*60	*59½	*60	Jan. '17,	0.05
Hilltop-Nev.	N. Y. Curb.	*13	*10	*10		
Kerr Lake	N. Y. Curb	2⅛	2⅛	2⅛	Oc. 1, Oc. 15, Q	0.12½
La Rose	Toronto	*29	*26	*29	Apr. '22,	0.10
McKinley-Dar.-Sav.	Toronto	*16½	*16	*16	Oct. '20, Q	0.03
Mining Corp. Can.	Toronto	2.63	2.53	2.60	Sept. '20, Q	0.12½
Nipissing	N. Y. Curb	5¼	5⅛	5⅛	y. 1, Jy. 20 Q	0.15
Ontario Silver	New York			3⅜	Jan. '19, Q	0.50
Temiskaming	Toronto	*38	*37	*38	Jan. '20, K	0.04

Stock	Exch.	High	Low	Last		Last Div.
GOLD						
Alaska Gold	New York	⅜	1⅛	1⅛		
Alaska Juneau	New York	⅛	⅛	⅛		
Boundary Red M.	N. Y. Curb			*12		
Carson Hill	Boston	5⅜	5⅛	5⅛		
Cresson Consol. G	N. Y. Curb	3 7/16	3⅛	3 7/16	July '23	2.00
Dome Mines	New York	34⅝	34	34	Je.30, Jy.20 Q	1.00
Golden Cycle	Colo. Springs	1.07	1.06	1.07	Dec. '22, Q	0.02
Hollinger Consol.	Toronto	11.80	11.65	11.75	Se.15, Oc.5, M	0.05
Homestake Mining	New York	61	61	61	Se.20, Se.25 M	0.50
Kirkland Lake	Toronto	*35½	*34¼	*35½		
Lake Shore	Toronto	3.50	3.40	3.45	Au. 1 Au. 15 '23, Q	0.02
McIntyre-Porcupine	New York	16⅝	15⅝	15⅝	Au. 1, Se. 1, Q	0.25
Portland	Colo. Springs			*38	Oct. '20, Q	0.01
Teck-Hughes	N. Y. Curb	1 1/16	1	1		
Tom Reed	Los Angeles			*55	Dec. '19,	0.02
United Eastern	N. Y. Curb	1¾	1 1/16	1 5/16	Jy. '28, Q	0.15
Vipond Cons.	Toronto	*75	*71	*74		
Wright-Hargreaves	Toronto	3.20	3.15	3.15	Apr. '23,	0.02½
Yukon Gold	N. Y. Curb			1¼	June '18,	0.02½
GOLD AND SILVER						
Boston-Mont. Corp.	N. Y. Curb	*12	*12	*12		
Con. Cortez	N. Y. Curb	*72	*68	*71		
Con. Virginia	San Francisco	10⅛	10	10⅛		
Continental Mines	N. Y. Curb	6	5	5⅞		
Dolores Esperanza	N. Y. Curb	1 1/16	1 1/16	1 1/16	Jy. 1, Jy. 10 Q	0.05
Jib Consol.	N. Y. Curb	*65	*65	*65		
Tonopah Belmont	N. Y. Curb			*65	Apr. '23, Q	0.05
Tonopah Divide	N. Y. Curb	*51	*50	*50	May 23	0.10
Tonopah Extension	N. Y. Curb	2¼	2⅛	2⅛	Se. 10, Oc. 1	0.05
Tonopah Mining	N. Y. Curb	1⅛	1⅛	1 1/16	Apr. '23, Q	0.07½
Unity Gold	N. Y. Curb			3¼		
West End Consol.	N. Y. Curb	*82	*79	*81	Mar. '23, Q	0.05
SILVER-LEAD						
Bingham Mines	Boston	16¼	16¼	16¼	Sept. 19, Q	0.25
Cardiff M. & M.	Salt Lake			*52	Dec. '20,	0.15
Chief Consol.	Boston Curb	3⅜	3⅜	3⅜	Au. 1, '23, Q	0.10
Columbus Rexall	Salt Lake	*40	*35½	*40	Aug. '22,	0.03
Consol. M. & S.	Montreal	26⅜	26⅜	26⅜	Oct. '20, Q	0.62½
Erupcion	Boston Curb	2⅜	2⅜	2⅜	Se. 15, Oc. 2	0.125
Federal M. & S.	New York	10	10	10	Au. 25, Se. 15	1.75
Federal M. & S. pfd.	New York	42½	40½	40½	June '23, Q	1.75
Florence Silver	Spokane	19	12	18½	Apr. '19, Q, X	0.01½
Hecla Mining	N. Y. Curb	6⅞	6⅜	6⅜	Au. 15, Se. 15	0.15
Iron Blossom Con.	N. Y. Curb	*24	*23	*24	July 16,	0.02½
Marsh Mines	N. Y. Curb	*7	*6	*6	June '21, I	0.02
Park City	Salt Lake	2.90	2.90	2.90	Je.15, Jy.2 Q	0.12½
Park Utah	N. Y. Curb			3	Je.15, Jy.2 Q	0.15
Prince Consol.	Salt Lake			*1	Nov. '17,	0.02½
Silversmith	Spokane	*37	*35	*37	Jy. 2, Jy. 10	0.02
Simon Silver-Lead	N. Y. Curb			*15		
Snowstorm Silver-L.	N. Y. Curb			*43		
Tamarack-Custer	Spokane	1.22	1.20	1.20	Je.30, K	0.02
Tintic Standard	Salt Lake	3.05	3.00	3.05	July '23	0.15
Utah-Apex	Boston	3⅜	3⅜	3⅜	June '23, Q, X	0.50
IRON						
Bethlehem Steel	New York	53	49⅞	52⅜	Se. 1, Oc. 1 Q	1.25
Char. Iron	Detroit			⅜		
Char. Iron pfd.	Detroit			1⅜		
Colorado Fuel & Iron	New York	30½	28	28	Au.10, Au.'25 Q	2.00
Col. Fuel & Iron pfd.	New York			102	Feb.'23, Q	2.00
Gt. North'n Iron Ore	New York	32⅛	29⅛	30⅛	Apr. '23	1.00
Inland Steel	N. Y. Curb			46⅛	Au.15, Se.1'23 Q	0.62½
Mesabi Iron	N. Y. Curb			6⅜		
Replogle Steel	New York	13¼	12½	12½		
Republic I. & S.	New York	49½	45⅞	47⅛	May '21	1.50
Republic I. S. pfd.	New York	93⅛	91	92⅛	Se.15, Oc.1 Q	3.75
Sloss-Sheffield S. & I.	New York	49	47	47⅞	Feb. '21	1.50
Sloss-Shef. S. & I. pfd.	New York			78	Je. 22, Jy. 2 Q	1.75
U. S. Steel	New York	92⅞	90⅞	91⅛	Au.30, Se.29, Q	1.25
U. S. Steel pfd.	New York	117½	117	117	Au.7, Au.30 Q	1.75
Virginia I. C. & C.	New York	56⅛	56⅛	56⅛	Je.16, Jy. 2	2.00
Virginia I.C.&C.pfd.	New York			78½	Je.16, Jy. 2	2.50
VANADIUM						
Vanadium Corp.	New York	33⅛	31	31	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp.	Montreal	50⅛	47	49⅛	Je.30, Jy.15 Q	1.50
Asbestos Corp. pfd.	Montreal	74⅜	73⅛	74	Je.30, Jy.15 Q	1.75
SULPHUR						
Freeport Texas	New York	13	11⅛	11⅛	Nov. '19, Q	1.00
Texas Gulf	New York	58⅛	56¼	58¼	Se.1, Se.15 Q	1.50
PLATINUM						
So. Am. Gold & P.	N. Y. Curb	3	2¾	3		
MINING, SMELTING AND REFINING						
Amer. Metal	New York	45⅛	43	43	Au. 20, Se. 1	0.75
Amer. Metal pfd.	New York			110	Au. 18, Se 1	1.75
Amer. Sm. & Ref.	New York	59⅞	58¼	59	Jy. 9, Au. 1	1.25
Amer. Sm.& Ref. pfd	New York			97½	Au.10, Se.1 Q	1.75
U. S. Sm. R. & M.	New York	25½	23⅜	25	Jan. '21, Q	0.50
U.S. Sm.R.& M. pfd.	New York	42⅜	42⅜	42⅜	Jy.6, Jy.14 Q	0.87½

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M. Monthly. K, Irregular. I, Initial. X, Includes extra.

Toronto quotations courtesy Arthur E. Moysey; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Mines and Oil; Colorado Springs, Colorado Springs Stock Exchange.

NEW MACHINERY AND INVENTIONS

An Air Preheater as a Source of Power-Plant Economy

The greatest source of loss in connection with steam-boiler operation is the quantity of heat carried away to waste by the flue gases. A high exit temperature of the gases is not now tolerated for the sake of producing natural draft, and economizers are fitted in all plants of any importance, to utilize as far as possible the heat which the boiler itself cannot extract from the gases. The close regulation of the excess air supply to the fires which is rendered possible by the use of CO_2 recorders has had its natural effect in increasing the temperature of the exit gases, and this again has called attention to the amount of recoverable heat which these gases contain. In addition to extracting a part of this heat by means of economizers, or, indeed, as an alternative to the use of economizers, it has often been proposed to use the heat of the waste gases to raise the temperature of air supplied the fire.

Up to the present, there are two ways by which it has generally been attempted to raise the temperature of air for combustion. In steel-works furnaces, a common practice is to pass the fresh air and the flue gases alternately through regenerating chambers, so that the incoming air picks up heat from the brickwork previously raised to a high temperature from the passage of the flue gases. For boiler furnaces the flue-gas temperature is not sufficiently high to make this plan practicable, quite apart from the difficulty of carrying it out. Hence when regeneration has been applied to steam-boiler plants it has been customary to transmit the heat from the waste gases to the incoming air, through metallic surfaces separating the air passages from the flues. Heat transmission under such circumstances is not very effective, as the temperature difference is not great and the surfaces of the heating device are likely to become covered with a layer of soot or tarry matter which acts as a non-conductor.

A third solution is in the "air preheater" which has been designed by Frederick Ljungstrom, of Stockholm. This preheater is unique in that it embodies neither of the principles referred to above, but carries heat continually in a mechanical way from the flue gases to the incoming air. The apparatus is compact and simple in operation, and is easily installed.

It is claimed that as an alternative to an economizer, the Ljungstrom air preheater is not only more efficient, but is somewhat lighter, and less expensive in first cost and maintenance.

The makers of the Ljungstrom air preheater in America are James Howden & Co. of America, Inc., Wellsville, N. Y.

Pulverizing 1,000 Tons of Ore Per Day on 80-kw. Input

Two Rod Mills Installed by Cananea Consolidated Copper Co. Are Equipped With Self-aligning Roller Bearings, Affording a Saving in Power Cost

BY CHESTER A. GAUSS

ONE THOUSAND tons of copper ore pulverized in twenty-four hours on a single mill with a motor input of only 80 kw. is what is being accomplished by the Cananea Consolidated Copper Co., of Cananea, Mexico. This production is obtained from each of two 6 x 12-ft. mills furnished by David Cole, consulting engineer, El Paso, Tex.

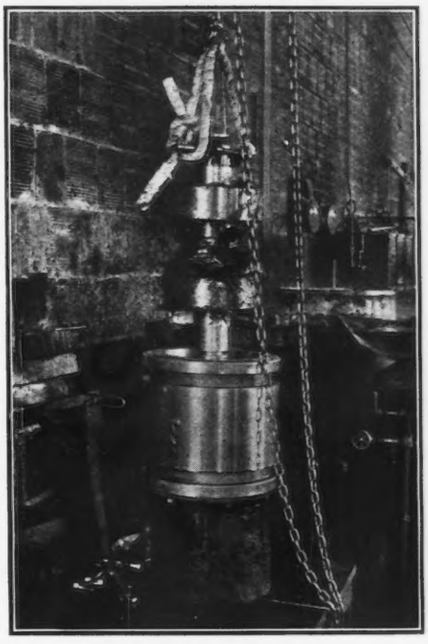


Fig. 1—One of the six roller units with which each mill is equipped.

Each roller (shown in process of assembly) is equipped with two self-aligning roller bearings and weighs 500 lb.

The mill itself is a cylinder which is charged through an opening in one end. Within the cylinder are steel rods lying longitudinally and which aggregate 40,000 lb. in weight. When the mill rotates, the rods and ore cascade down one side, and the ore is pulverizer.

By using the rods, more uniform pulverizing is obtained than with balls, and then, too, when the rods are worn down below the point of usefulness for pulverizing, they can be salvaged for other service.

Around the circumference of the cylinder is a riding ring which rests on six rollers, connected by links in the form of a chain supported at its ends. Each of the six rollers is supported by two SKF self-aligning roller bearings, which are responsible in a large measure for the high efficiency and reliable performance of the mill. One of these roller units in process of assembly is shown in Fig. 1, and in Fig. 2 the complete chain is shown assembled in its cradle.

The total weight of the cylinder, rods, and charge of ore is 100,000 lb., of which 85,000 lb. is carried by the roller chain, placing a load of approximately 8,000 lb. on each of the twelve self-aligning roller bearings. Normally the cylinder revolves at 16 r.p.m., making a roller speed of 106 r.p.m. necessary.

As compared with other types of machines equipped with sleeve types of bearings, this roller-bearing equipped mill requires approximately 35 per cent less power. Some idea of the magnitude of this saving can be obtained by remembering that it corresponds to a saving in power input of 43 kw. Assuming that electric energy can be obtained at the low rate of 2½c. per kilowatt-hour, this corresponds to a saving of $10.75 per day of twelve hours, or of $3,923.75 per 365-day year of twelve hours a day operation. With power costs forming such a large per centage of the cost of pulverizing ores, this saving of approximately 35 per cent has a substantial effect upon total cost of reducing ores.

Another advantage claimed for this type of mill is the fact that lubrication troubles and those experienced as a result of the dirty, gritty conditions under which pulverizing mills must operate are avoided. Large lubricant reservoirs are provided for the roller bearings, and, since the housings are leak-proof, lubricant need be applied only at infrequent intervals. The housing seals which keep the lubricant from leaking out also prevent dust and grit from finding their way into the bearings and acting as a potent force of destruction. Shutdowns for bearing adjustments such as are required with plain-bearing equipment are thus avoided. This non-wearing feature of self-aligning roller bearings is one that appeals greatly to mills situated at places difficult of access and far from sources of supply.

Since the use of these self-aligning roller bearings plays such a large part in the efficiency and reliability of this mill, the design and characteristics of this type of bearing, which differ greatly from those of conventional types, are of special interest. It will be seen from Fig. 3 that this recently developed bearing is a self-contained and self-aligning unit. The former feature means that when the bearing is being installed no internal adjustment of the bearing is required, thus precluding the possibility of damage through initial maladjustment while installing. A spherically ground outer

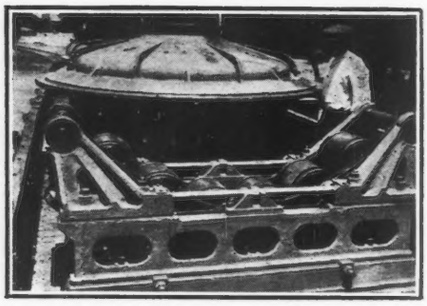


Fig. 2—Roller chain assembled in its cradle

The center-line distance between holes in the links made accurate to 0.003 in.

race provides for self-alignment of the bearing to compensate for shaft deflections and unavoidable inaccuracies in machining and locating the housings. These two features are of particular importance in the field of heavy machinery for which the bearing was designed.

Considering the bearing in detail, it is composed of an inner race, two rows of rollers with a separate retainer for each row and an outer race. The inner race is secured to the shaft by the same methods employed with ball bearings operating under corresponding load and speed conditions—that is, by means of a shrink or a press fit.

Two separate grooves are provided on this inner race, one for each row of rollers. The curvature of these grooves conforms to that of the rollers, which are barrel shaped, thus providing the line contact of the roller bearing.

The outer race is ground spherical on the inner surface, the center of the sphere coinciding with the center of the bearing. With this outer race the rollers are in theoretical point contact. Due to the elasticity of the parts and the fact that the radius of curvature of the rollers corresponds rather closely with that of the spherically ground outer race, this contact is very intimate and is fully comparable with that of a ball bearing provided with balls of large diameter.

It will be seen that the rollers are barrel shaped and have their largest diameter toward the inboard end. Actually, the contact between the roller and the outer race is a substantial area, due to the elasticity of these parts and consequent deformation under load. This roller bearing thus embodies the theoretical characteristics of both the point contact of the ball bearing and the line contact of the roller bearing. As the line contact is provided on the inner race, which is the weaker element in the typical annular bearing, the result is an excellent equalization of the stress between the inner and outer races.

Any type of bearing which aims to obtain line contact must provide some means for maintaining the parallelism of the axes of the rollers with the shaft. Otherwise the skewing of the rollers destroys the line contact and substitutes an objectionable form of point contact. In the SKF self-aligning roller bearing, the desired result is accomplished in a positive manner by means of guiding flanges forming the shoulder between the two grooves on the inner race. Both the flanges and the ends of the rollers are ground spherical surfaces with their center at the point of intersection of the shaft axis and the axes of the rollers. Since the guiding flanges and the roller ends have the same center and the same radius of curvature, they contact over an area—not at point. The force reactions of the inner and outer races are at an angle to each other, and result in a wedging force that holds the roller in contact with the guiding flange. As soon as a roller skews in the slightest degree, there is no longer a contact area between the end of the roller and the guide flange, but merely a single point of contact at the edge of the roller. The force reaction at this point, together with the force reactions of the inner and outer race, forms a couple which immediately counteracts any tendency to skew and returns the roller to its position of equilibrium.

The rollers are thus maintained in a parallel relation with the shaft axis by this positive action, which provides in the design of the bearing itself a stable equilibrium of the roller. The advantage of this provision is immediately reflected in the low coefficient of friction, which is somewhat greater than that of a ball bearing, but markedly lower than in the common types of roller bearings. The retainer rides on the land of the inner race and serves only to separate adjacent rollers and to prevent their contacting with each other.

Because of the fact that the inner surface of the outer race is spherically ground and that the rollers are barrel shaped, the inner race, rollers, and retainers are free to operate at an angle within the outer race to compensate for shaft misalignment. The principle of the ball-and-socket joint is thus embodied in the bearing itself, eliminating the need of spherically ground bearing deats or other external aligning devices.

In equivalent sizes this roller bearing has about twice the load capacity of the corresponding ball bearing. The thrust capacity of the bearing is substantial, making the bearing well adapted to the carrying of combined loads. The thrust capacity is obtained by the angle of contact between the load reactions on the rollers and the axis of the shaft and is not dependent on the guiding flange reaction.

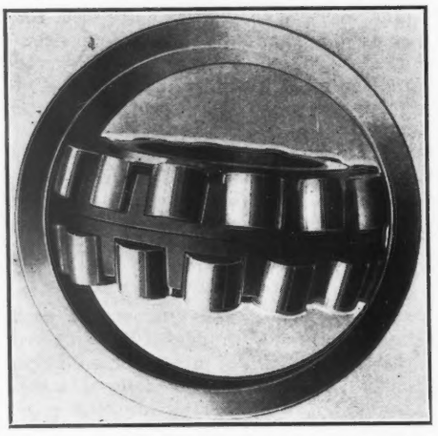


Fig. 3 — Self-aligning roller bearing with inner race rollers, and retainer turned at right angles to the outer race.

INDUSTRIAL NOTES

Suit has been entered by the government against the Nashville Industrial Corporation in the Federal Court of the Middle District of Tennessee asking that the contract held by that corporation with the government covering the sale of the Old Hickory plant be rescinded. The government alleges fraud in the original sale of the plant. By stipulation, it was agreed that a receivership of the property would not be opposed by either side, and accordingly Judge Core of the above court appointed B. P. Morse, present manager of the Nashville Industrial Corporation, and W. P. Smith, Assistant District Attorney, joint receivers, and issued instructions that the business should be carried on as usual, that sales of both realty and personalty shall be made, and all activities instituted by the corporation shall continue under direction of the court.

No receivership of the Nashville Industrial Corporation was asked by the government. Both sides have stipulated that no dilatory motions will be made and that the case shall be brought before the court for decision soon.

The plans of industrialization of Old Hickory will continue, as it is the desire of both the government, as expressed by A. T. Seymour, First Assistant Attorney General, and the Nashville Industrial Corporation that an industrial city be made of this war expenditure. As charges have been made that there was fraud in the sale of the property, it was felt by both litigants that the question should be definitely settled in order that industrialization might proceed with absolute safety to industries the managements of which might be considering establishing them at this point.

This suit will in no way interfere with the location of the du Pont Fiber Silk Corporation, as already announced. All sales contracts made by the corporation and now existing will be taken over and consummated by the receivers.

Bulletin No. 34 of the Nordberg Manufacturing Co., Milwaukee, Wis., just issued, describes the Nordberg counter-current aftercooler. The purpose of the aftercooler is two-fold; first, cooling the hot air after it has left the compressor, and, second, drying it by bringing the hot, moist air in contact with water-cooled surfaces, thereby condensing it. The bulletin has seven pages and is illustrated.